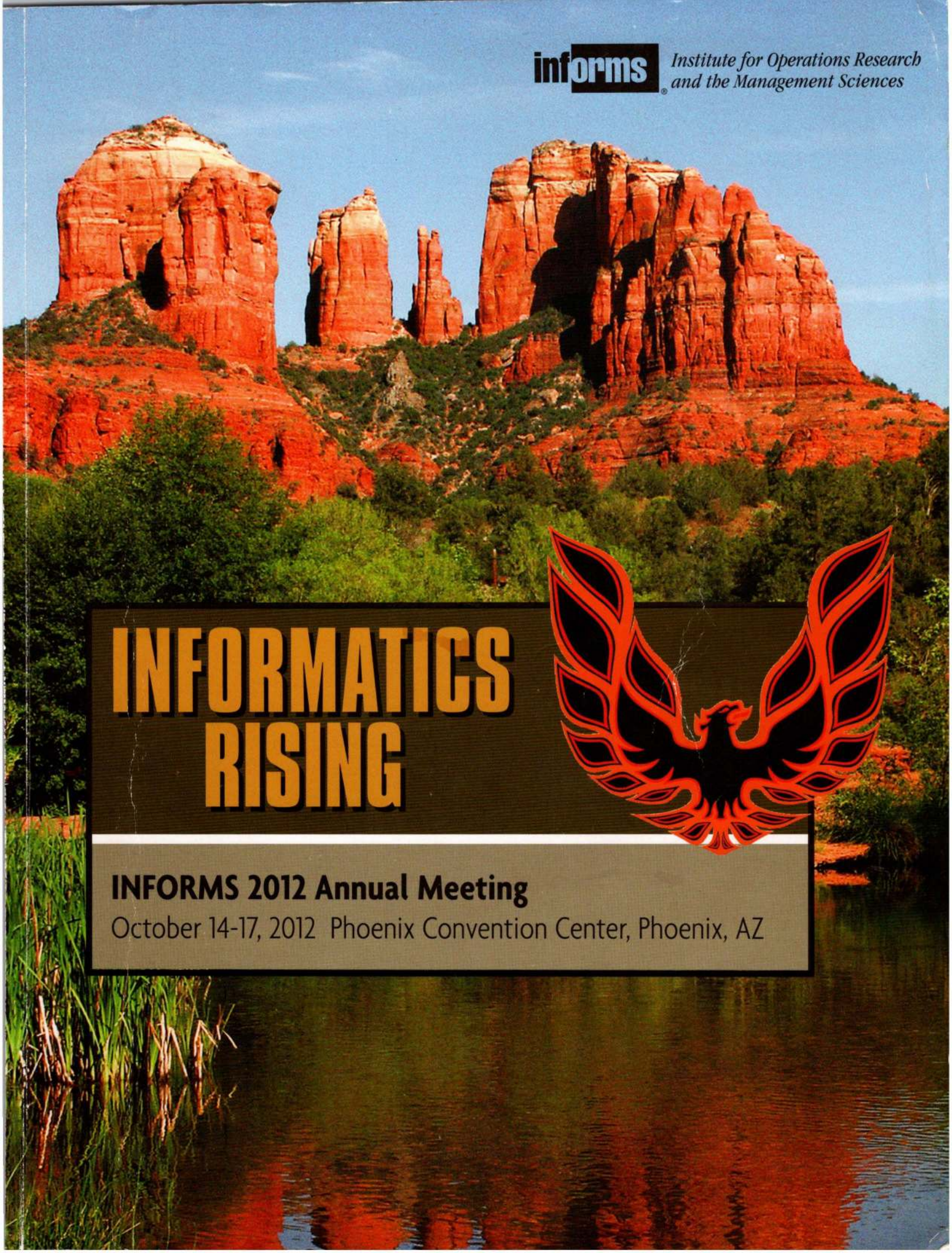
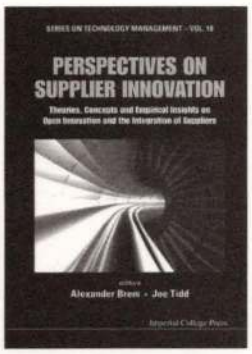

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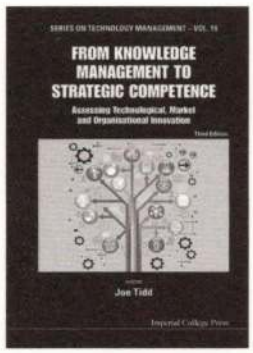
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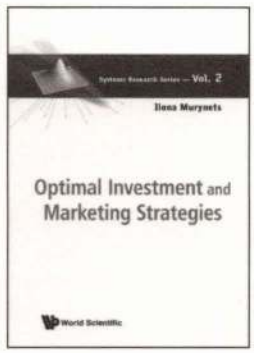
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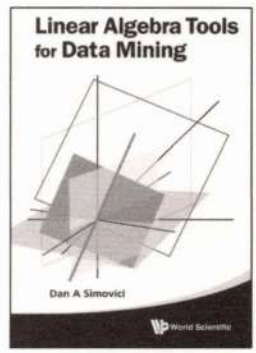
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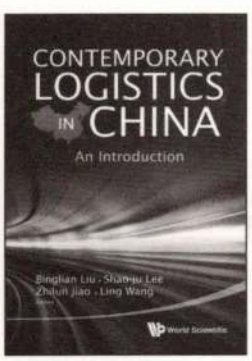
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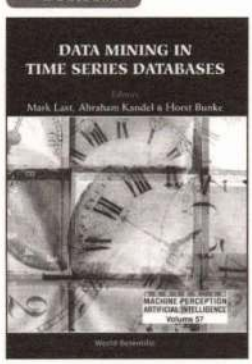
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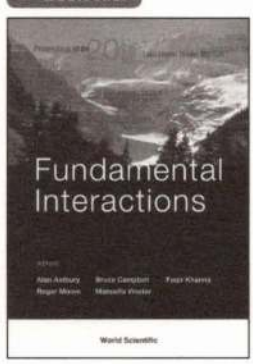
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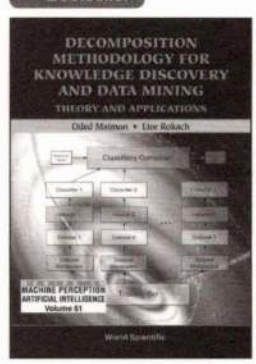
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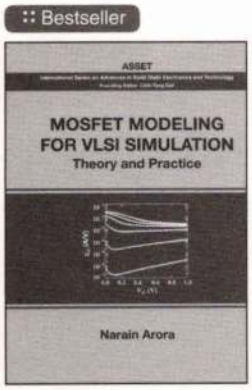
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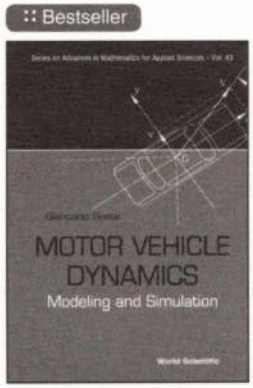
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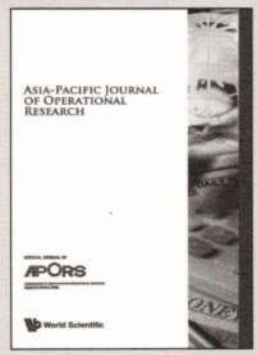
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THE SETH BONDER FOUNDATION

Dear INFORMS Friends,

Welcome to Phoenix and the 2012 INFORMS Annual Meeting. It's my great pleasure to welcome you to the Valley of the Sun, where technology, culture, climate and nature come together in an abundance of opportunity and enjoyment. From the Navigator volunteers and internet service that help make Phoenix Sky Harbor America's Friendliest Airport® to the orange-shirted Downtown Phoenix Ambassadors that can help you find your way around, you will find Phoenix to be a warm and welcoming place.

The conference theme "Informatics Rising" symbolizes the increasingly important role OR/MS technologies play in advancing society. From analytics to large-scale modeling, the technologies developed and applied by the INFORMS community are helping companies thrive in competition, ensuring homeland security, advancing environmental sustainability and simply adding to our quality of life. In keeping with the theme, we have lined up an outstanding set of plenary and keynote addresses. Ret. Gen. Richard O'Lear opens the meeting with OR Applications for Intelligence, Surveillance and Reconnaissance. Complementing this presentation, Caryl Brzymialkiewicz will present the role of Risk and Decision Sciences in the Department of Homeland Security. Bill Pulleyblank will discuss Analytics for a Networked World as the Philip McCord Morse Lecturer, George Poste will present Computational and Analytical Challenges in Personalized Medicine, and Intel Fellow Alan Gara will inform us on the Future of High Performance Computing. Nobel Laureate Edward Prescott will cover OR in Aggregate Economics in the Omego Rho Distinguished Lecture. We are also pleased to present Paolo Toth as the IFORS Distinguished Lecturer on Railway Optimization; Christopher Lofgren, President and CEO of Schneider National, on Innovation; and Wally Hopp on the Future of Manufacturing. And, of course, we will have our Edelman Reprise and Wagner Prize presentations. New this year will be the George D. Smith Prize presentation for effective and innovative student preparation and the opportunity to hear the Society of Medical Decision Making panel of experts.

You won't want to miss the General Reception on Tuesday evening. This year's event will be held in the Convention Center with the theme "Get Your Kicks on Route 66." I hope you'll join us for an evening of fun, food, music, networking and surprises as we relive the adventure and scenic beauty of the classic two-lane highway that passed through Northern Arizona as it connected Chicago to California.

Organizing a conference of this scale requires the efforts of many individuals. I would like to thank all of them for their hard work to ensure all attendees leave intellectually fulfilled and spiritually refreshed. As many of you know from previous conferences, the INFORMS staff defines professionalism and customer service; without their guidance and efforts, this conference would not be possible. I am also grateful to the Organizing Committee. Co-Program Chairs Esma Gel and John Fowler put together a wonderful program including integration with the Society of Medical Decision Making. Karl Kempf led the effort to ensure the practice of OR/MS would be well represented with assistance from Mani Janakiram. Karl also assisted with lining up the plenary and keynote speakers. Baris Ata and Rui Yin coordinated the Sponsored Sessions, Scott Mason and Feryal Erhun put together an exciting set of timely Invited Clusters, and Mary Beth Kurz and Hongmin Li organized the Contributed Sessions. Pitu Mirchandani lined up a distinguished set of tutorial speakers covering timely topics. Young Jun Son organized the Interactive Sessions with help from Jian Liu and Burcu Keskin. Mohan Gopalakrishnan put together the plant trips and Srimathy Mohan organized the gold-shirted student helpers you will find around the venue ready to answer any questions that arise. Jackie Askin took charge of organizing guest program activities. Finally Shamin Shirodkar assisted with Local Arrangements.

I would also like to thank our university and corporate sponsors for their generous financial support of the annual meeting. Singapore University of Technology and Design, Arizona State University, Wiley, GAMS, AIMMS, Purdue University, SAS, The University of Arizona, Texas A&M University, UT-Dallas, Iowa State University and The Bonder Foundation all contributed to this event.

Enjoy the conference. I both invite and encourage you to take full advantage of all the cultural and scenic experiences Phoenix and the Southwest have to offer.



Ronald G. Askin, General Chair

Program at a Glance

NOTE:
Technical sessions are held at the Phoenix Convention Center and the Hyatt Regency Phoenix, with some special events at the Renaissance Phoenix. Check the Master Track Schedule on pages 44-51 for specific room locations.

KEY
C-Convention Center
H-Hyatt
R-Renaissance

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2012 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. All attendees, including speakers and session chairs, must register and pay the registration fee. Lost badges can be replaced at the registration desk for a fee of $5.00.

QUICK REFERENCE

including the Master Track Schedule
Don't miss this handy reference. It's a separate flyer that came with your program. The Master Track Schedule is also printed on pages 44-51.

FRIDAY, OCTOBER 12

6:00pm-8:00pm	Combined Colloquia	H – Regency AB

SATURDAY, OCTOBER 13

7:00am-7:00pm	Registration Opens	C – West 301 BCD
7:30am-4:30pm	Future Academician Colloquium	H – Regency C
7:30am-4:30pm	Future Practitioner Colloquium	H – Sundance
7:30am-4:30pm	Teaching Effectiveness Colloquium	H – Gilbert
8:30am-5:30pm	DM-HI Workshop	H – Borein
8:30am-5:15pm	CIST	R – Salon 2,3
9:00am-5:30pm	Vendor (Exhibitor) Workshops	H – See p. 18
5:00pm-6:00pm	INFORMS Membership Meeting	H – Regency AB

SUNDAY, OCTOBER 14

7:00am-5:00pm	Registration	C – West 301 BCD
7:00am-5:00pm	Email Center, Free Internet	C – Exhibit Hall, West 301
8:00am-9:30am	Technical Sessions (SA)	Center, Hyatt
8:00am-4:30pm	CIST	R – Salon 1-4
9:30am-10:00am	Coffee Break	Center, Hyatt
10:00am-10:50am	Welcome/Plenary: Richard J. O'Lear	C – West 301A
11:00am-12:30pm	Technical Sessions (SB)	Center, Hyatt
12:00pm-5:00pm	Exhibits, Job Fair	C – Exhibit Hall, West 301
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Center, Hyatt
3:10pm-4:00pm	Keynote: Edelman Reprise	C – West 301A
3:10pm-4:00pm	Keynote: George Poste	C – West 101
4:00pm-4:30pm	Coffee Break	Center, Hyatt
4:30pm-6:00pm	Technical Sessions (SD)	Center, Hyatt
4:30pm-5:30pm	New Member Orientation	R - Pueblo
6:15pm-7:15pm	INFORMS Community Meetings	See p. 11
7:30pm-9:00pm	Welcome Reception-Exhibits Open	C – Exhibit Hall, West 301
8:30pm-9:45pm	Awards Ceremony & Dessert Reception	C – West 101
	Reception open to ceremony attendees only; doors close at 8:45pm.	

MONDAY, OCTOBER 15

7:00am-5:00pm	Registration	C – West 301 BCD
7:00am-5:00pm	Email Center, Free Internet	C – Exhibit Hall, West 301
8:00am-9:30am	Technical Sessions (MA)	Center, Hyatt
9:00am-5:00pm	Exhibits, Job Placement	C – Exhibit Hall, West 301
9:30am-10:00am	Coffee Break	Center, Hyatt
10:00am-10:50am	Plenary: William R. Pulleyblank Philip McCord Morse Lecture	C – West 301A
11:00am-12:30pm	Technical Sessions (MB)	Center, Hyatt
12:30pm-1:30pm	Lunch Break (on your own)	
12:30pm-2:30pm	Interactive Session	C – Ballroom 301 Foyer
1:30pm-3:00pm	Technical Sessions (MC)	Center, Hyatt
3:10pm-4:00pm	Keynote: Wallace J. Hopp	C – West 301A
3:10pm-4:00pm	Keynote: Alan Gara	C – West 101
4:00pm-4:30pm	Coffee Break	Center, Hyatt
4:30pm-6:00pm	Technical Sessions (MD)	Center, Hyatt
6:15pm-7:15pm	INFORMS Community Meetings	See p. 11

TUESDAY, OCTOBER 16

7:00am-5:00pm	Registration	C – West 301 BCD
7:00am-5:00pm	Email Center, Free Internet	C – Exhibit Hall, West 301
8:00am-9:30am	Technical Sessions (TA)	Center, Hyatt
9:00am-5:00pm	Exhibits, Job Placement	C – Exhibit Hall, West 301
9:30am-10:00am	Coffee Break	Center, Hyatt
10:00am-10:50am	Plenary: Edward C. Prescott Omega Rho Distinguished Lecture	C – West 301A
11:00am-12:30pm	Technical Sessions (TB)	Center, Hyatt
12:30pm-1:30pm	Lunch Break (on your own)	
12:30pm-2:30pm	Interactive Session	C – Ballroom 301 Foyer
1:30pm-3:00pm	Technical Sessions (TC)	Center, Hyatt
3:10pm-4:00pm	Keynote: Paolo Toth IFORS Distinguished Lecture	C – West 301A
3:10pm-4:00pm	Keynote: Christopher B. Lofgren	C – West 101
3:10pm-4:00pm	Keynote: UPS George D. Smith Reprise	C – West 207
4:00pm-4:30pm	Coffee Break	Center, Hyatt
4:30pm-6:00pm	Technical Sessions (TD)	Center, Hyatt
6:15pm-7:15pm	INFORMS Community Meetings See p. 11	
7:30pm-10:00pm	General Reception	C – North Ballroom Level 1 (Street Level)

WEDNESDAY, OCTOBER 17

7:00am-4:30pm	Registration	C – West 301 BCD
7:00am-4:30pm	Email Center, Free Internet	C – Exhibit Hall, West 301
8:00am-9:30am	Technical Sessions (WA)	Center, Hyatt
9:00am-1:00pm	Exhibits	C – Exhibit Hall, West 301
9:00am-3:00pm	Job Placement	C – Exhibit Hall, West 301
9:30am-10:00am	Coffee Break	Center, Hyatt
10:00am-10:50am	Keynote: Caryl Brzymialkiewicz	C – West 301A
10:00am-10:50am	Keynote: 2012 Wagner Presentation	C – West 101
11:00am-12:30pm	Technical Sessions (WB)	Center, Hyatt
1:30pm-3:00pm	Technical Sessions (WC)	Center, Hyatt
3:00pm-3:20pm	Coffee Break	Center, Hyatt
3:20pm-4:50pm	Technical Sessions (WD)	Center, Hyatt
5:00pm-5:50pm	Plenary: Joint INFORMS-SMDM Program Mark S. Roberts, Panel Moderator	C – West 301A

ANALYTICS CERTIFICATION RECEPTION

Tuesday, 6:15pm-7:15pm
Hyatt - Regency A
We welcome all those attendees who would like more information about analytics certification, which INFORMS will offer in 2013. Please join us at this reception; a brief presentation will be given by members of the INFORMS Certification Task Force.

COFFEE BREAKS

Sunday	
9:30am-10:00am	C – West, Ballroom 301 Foyer and West 101 Foyer H – Atrium Lobby
4:00m-4:30pm	C – Exhibit Hall, West 301 H – Atrium Lobby
Monday	
9:30am-10:00am	C – Exhibit Hall, West 301 H – Atrium Lobby
4:00m-4:30pm	C – Exhibit Hall, West 301 H – Atrium Lobby
Tuesday	
9:30am-10:00am	C – Exhibit Hall, West 301 H – Atrium Lobby
4:00m-4:30pm	C – Exhibit Hall, West 301 H – Atrium Lobby
Wednesday	
9:30am-10:00am	C – Exhibit Hall, West 301 H – Atrium Lobby
3:00m-3:20pm	C – West, Ballroom 301 Foyer H – Atrium Lobby

THANK YOU

Monday Coffee Breaks

THE UNIVERSITY OF ARIZONA.

Tuesday Coffee Breaks

IOWA STATE UNIVERSITY

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WHERE TO GO FOR LUNCH

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North building of the Convention Center, Street Level
Bistro on Third
City Center Coffee
Crust
Tortillas Mexican Grill
Urban Wok

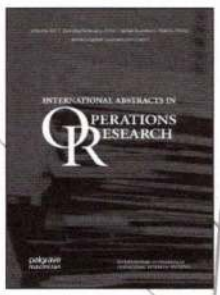
Hyatt Hotel
Einstein Brothers Café
Networks Bar & Grill

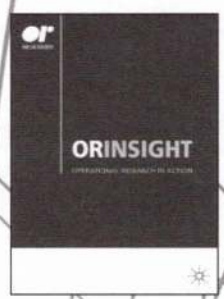
Renaissance Hotel
Marston's Cafe

palgrave
macmillan

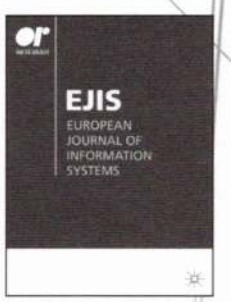
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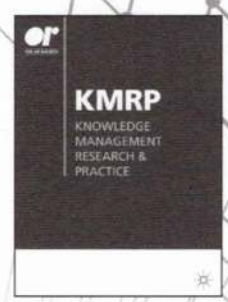


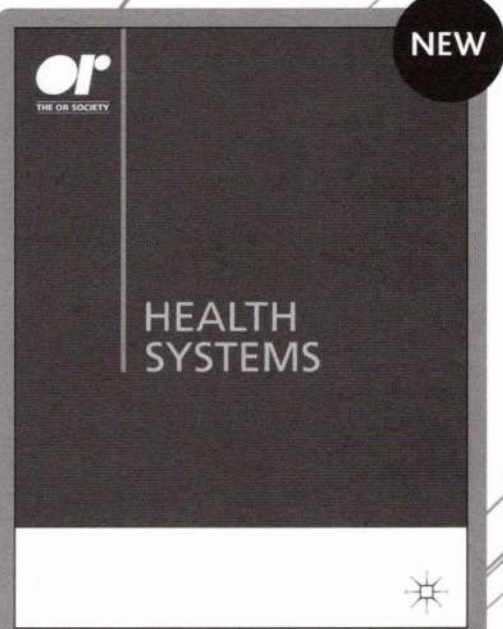












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FRIDAY, OCTOBER 12

Combined Colloquium Dinner	H – Regency AB	6:00pm-8:00pm

SATURDAY, OCTOBER 13

Combined Colloquia		
Breakfast	H – Regency AB	7:30am-8:15am
Future Practitioner Colloquium	H – Sundance	8:15am-4:30pm
Future Academician Colloquium	H – Regency C	8:15am-4:30pm
Teaching Effectiveness Colloquium	H – Gilbert	8:15am-4:30pm
Lunch	H – Regency AB	11:45am-1:15pm
Colloquia Dinner	H – Atrium Terrace	7:00pm-9:00pm
CIST Breakfast/Welcome	R – Salon 6-8	7:30am-8:30am
CIST Conference	R – Salons 2,3	8:30am-5:00pm
CIST Lunch & Speaker	R – Salons 6-8	12:00pm-1:30pm
Meetings Committee	H – Grand Canyon Suite 747	8:00am-12:00pm
DM-HI Breakfast/Welcome	H – Borein	8:30am-9:00am
DM-HI Workshop	H – Remington & Russell	9:00am-5:30pm
DM-HI Speaker & Lunch	H – Pima	11:30am-2:00pm
ISR Editors	R – Gila	8:00am-2:00pm
INFORMS Executive Committee	R – Boardroom	8:30am-12:00pm
Organization Science Competition	H – Suite 318	8:30am-5:00pm
Vendor Workshops – Session I		
AnyLogic	H – Phoenix East	9:00am-11:30am
McGraw-Hill	H – Cowboy Artists	9:00am-11:30am
SAS Global Academic Program	H – Phoenix West	9:00am-11:30am
Spry, Inc.	H – Suite 312	9:00am-11:30am
Vendor Workshops – Session II		
AIMMS (Paragon)	H – Suite 322	12:00pm-2:30pm
American Optimal Decisions	H – Suite 324	12:00pm-2:30pm
Gurobi Optimization	H – Phoenix East	12:00pm-2:30pm
JMP Software from SAS	H – Phoenix West	12:00pm-2:30pm
Lumina Decision Systems	H – Suite 312	12:00pm-2:30pm
Maximal Software, Inc.	H – Suite 314	12:00pm-2:30pm
Palisade Corp.	H – Suite 316	12:00pm-2:30pm
Tableau Software	H – Cowboy Artists	12:00pm-2:30pm
INFORMS Board Meeting	R – South Ballroom	12:00pm-5:00pm
Vendor Workshops – Session III		
FICO	H – Phoenix East	3:00pm-5:30pm
Frontline Systems, Inc.	H – Suite 312	3:00pm-5:30pm
GAMS Development Corp.	H – Suite 314	3:00pm-5:30pm
IBM-ILOG Optimization	H – Cowboy Artists	3:00pm-5:30pm
Imagine That	H – Suite 316	3:00pm-5:30pm
LINDO Systems	H – Suite 322	3:00pm-5:30pm
Salford Systems	H – Suite 324	3:00pm-5:30pm
SAS	H – Phoenix West	3:00pm-5:30pm
INFORMS Membership Meeting/Reception	H – Regency AB	5:00pm-6:00pm
O.R. Task Force	R – Salon 7	5:00pm-8:00pm
INFORMS Roundtable		
Roundtable Reception	H – Curtis	5:00pm-6:00pm
Roundtable Meeting	H – Regency D	6:00pm-9:30pm
Roundtable Dinner	H – Curtis	7:30pm-8:30pm
CIST/ISR Editors Reception	R – Goldwater	6:00pm-7:30pm
Organization Science Reception	H – Networks Lobby Bar	6:00pm-7:30pm
University of Texas at Dallas Reception	H – Gilbert	6:00pm-9:00pm
University of Southern California Reception	R – Salon 8	7:30pm-9:00pm

KEY
C-Convention Center
H-Hyatt
R-Renaissance

JOB PLACEMENT SERVICES

Job Fair
Sunday
12:00pm-5:00pm
Convention Center – Exhibit Hall
The Job Fair provides an opportunity for job seekers to meet participating employers in an informal atmosphere and to discuss employment opportunities within those organizations. Employers meet and collect resumes from many job seekers in a short period of time early in the meeting, giving them the chance to set up interviews during the meeting.

INFORMS Job Placement Service
Monday-Tuesday, 9:00am-5:00pm
Wednesday, 9:00am-3:00pm
Convention Center – Exhibit Hall
This service provides employers and applicants with a convenient venue for on-site interviews to explore opportunities in academia, industry and government. In addition, the job placement service offers:
– Online access to job listings and applicant files,
– Expanded information about jobs and applicants,
– Weekly updates of the database,
– Improved database search capabilities,
– Online data entry for applicants and employers,
– Extended availability of the database.
www.informs.org/JPS/

Job Placement Panel Discussions
Select panels will lead informal discussions about the industry and academic interview processes.

The Academic Job Search
Monday, 11:00am-12:30pm (MB45)
Center – North 229A

The Industry Job Search
Monday, 1:30pm-3:00pm (MC45)
Center – North 229A

Schedule of Special Events

GOING GREEN

INFORMS is committed to making the Annual Meeting environmentally friendly. We encourage all attendees to join in this effort by being aware of opportunities to minimize our mutual carbon footprint.

Green Initiatives at the Convention Center
Sustainability is one of the core values at the Phoenix Convention Center, from partnership with local farmers to a green purchasing program and solar power plant. The Convention Center is responsible for over 1,400 tons of recycled materials between 2009 and 2011. Distinct recycling bins are available throughout all facilities. The facility's caterer, Aventura, also implements sustainable policies and procedures.

Printed Program – approximately 31% of meeting attendees chose to not receive the hard-copy printed program. PDFs of the final program were provided online so these attendees could print out sections of interest before traveling to Phoenix. Reference copies of the program will be available at all Session Monitor desks and the Program Information booth (see maps on pages 42-43 for locations). In addition, all attendees received the Quick Reference, which summarizes the technical session schedule, special events and community meeting listings, and maps of the Center, Hyatt and Renaissance.

Sustainable Registration Materials – the meeting badge holder is made from recycled materials. We hope you will reuse or donate your bag when you return home. At the end of the meeting, INFORMS will provide special bins at the Registration Desk where you can deposit these materials if you don't want to take them home.

KEY
C-Convention Center
H-Hyatt
R-Renaissance

SUNDAY, OCTOBER 14

INFORMS Roundtable		
Roundtable Breakfast	H – Gilbert	7:00am-8:00am
Roundtable Meeting	H – Regency D	8:00am-5:00pm
Roundtable Lunch	H – Gilbert	12:15pm-1:15pm
Roundtable/INFORMS Board	H – Regency D	4:00pm-5:00pm
President's Reception Roundtable	H – Sundance	5:00pm-6:00pm
JPS Breakfast	H – Regency C	7:30am-9:00am
INFORMS Board Meeting	R – South Ballroom	8:00am-3:30pm
CIST Breakfast	R – Salons 6-8	7:30am-8:30am
CIST Conference	R – Salons 2,3	8:30am-5:30pm
CIST Lunch & Awards	R – Salons 6-8	12:00pm-2:00pm
Plenary: Richard J. O'Lear	C – West 301A	10:00am-10:50am
CIEADH	R – Gila	10:00am-5:45pm
Omega Rho Lunch/Meeting	H – Moran	11:00am-1:00pm
MSOM Associate Editors	H – Cassidy	12:30pm-2:30pm
Keynote: 2012 Edelman Reprise	C – West 301A	3:10pm-4:00pm
Keynote: George Poste	C – West 101	3:10pm-4:00pm
New Member Orientation	H – Regency C	4:30pm-5:30pm
IOL & Social Networking Reception	H – Cassidy	6:00pm-7:00pm
Interfaces Editors	H – Boardroom	6:15pm-7:15pm
Welcome Reception-Exhibits Open	C – Exhibit Hall, West 301	7:30pm-9:00pm
Wharton Alumni Reception	H – Gilbert	7:30pm-9:30pm
Minority Issues Forum Reception & Posters	H – Cowboy Artists	8:00pm-9:00pm
Awards Ceremony & Dessert Reception	C – West 101	8:30pm-9:45pm

Reception open to ceremony attendees only; doors close at 8:45pm.

MONDAY, OCTOBER 15

Board/Editors/Committee Chair Breakfast	R – Salons 1-2	7:00am-8:00am
Bonder Scholarship Breakfast	R – Salon 8	7:00am-10:00am
OR Editors Meeting	H – Gilbert	7:30am-9:00am
ACORD Breakfast/Meeting	R – Havasupai	7:30am-9:00am
Chapters/Fora Committee	R – Salon 6	8:30am-9:30am
Section & Societies Committee	R – Salon 7	9:30am-10:30am
Decision Analysis Editors	H – Sundance	9:30am-11:00am
Plenary-McCord Morse: William Pulleyblank	C – West 301A	10:00am-10:50am
Sections/Societies Officers Lunch	R – Salons 1-2	12:00pm-1:30pm
COIN-OR Members & Users	C – West 212B	12:15pm-1:15pm
SPPSN Lunch	H – Regency D	12:30pm-1:30pm
Junior Faculty Interest Group Lunch	Offsite/Kincaids	12:30pm-1:30pm
Publications/Editors in Chief	H – Cowboy Artists	12:30pm-3:30pm
International Activities Committee	R – Salon 3	12:45pm-1:45pm
Fellows Lunch	H – Regency C	12:45pm-2:30pm
Subdivisions Council	R – Gila	2:30pm-4:30pm
Keynote: Wallace J. Hopp	C – West 301A	3:10pm-4:00pm
Keynote: Alan Gara	C – West 101	3:10pm-4:00pm
Texas A&M Reception	R – Salons 6-7	6:00pm-7:00pm
Carnegie Mellon-Tepper School Reception	R – Salon 2	6:00pm-8:00pm
University of Michigan Reception	R – Salon 8	6:00pm-8:00pm
CPMS Isolated Practitioners Workshop	C – North 225A	6:15pm-7:15pm
Tsinghua University Reception	R – Havasupai	6:15pm-7:15pm
University of Florida-ISE Reception	R – Goldwater	6:30pm-7:30pm
Military Applications Reception	C – North 231C	7:15pm-10:15pm
Student Awards & Reception	H – Regency A	7:30pm-9:30pm
University of Texas at Austin Reception	R – Salons 3-4	7:30pm-9:30pm

TUESDAY, OCTOBER 16

Chapters/Fora Officers Breakfast	H – Regency C	7:00am-8:00am
Transportation Science Editors	H – Boardroom	7:30am-9:00am
Korea Chapter Breakfast	H – Regency D	7:30am-9:00am
Student Chapter Officers	H – Regency C	8:00am-8:45am
Phoenix Area Math Teacher Workshop	Off-Site	8:00am-3:00pm
Meetings Committee	H – Grand Canyon Suite 747	8:30am-5:00pm
Plenary-Omega Rho: Edward C. Prescott	C – West 301A	10:00am-10:50am
JOC Editors Meeting/Lunch	H – Cassidy	12:30pm-1:30pm
Women in OR/MS Lunch	H – Regency C	12:30pm-1:30pm
Keynote-IFORS: Paolo Toth	C – West 301A	3:10pm-4:00pm
Keynote: Christopher B. Lofgren	C – West 101	3:10pm-4:00pm
Keynote: UPS George D. Smith Reprise	C – West 207	3:10pm-4:00pm
Future Organizing Committee Reception	H – Cowboy Artists	5:00pm-6:00pm
Analytics Certification Reception	H – Regency A	6:15pm-7:15pm
General Reception – Route 66 Party	C – North Ballroom, Level 1	7:30pm-10:00pm

WEDNESDAY, OCTOBER 17

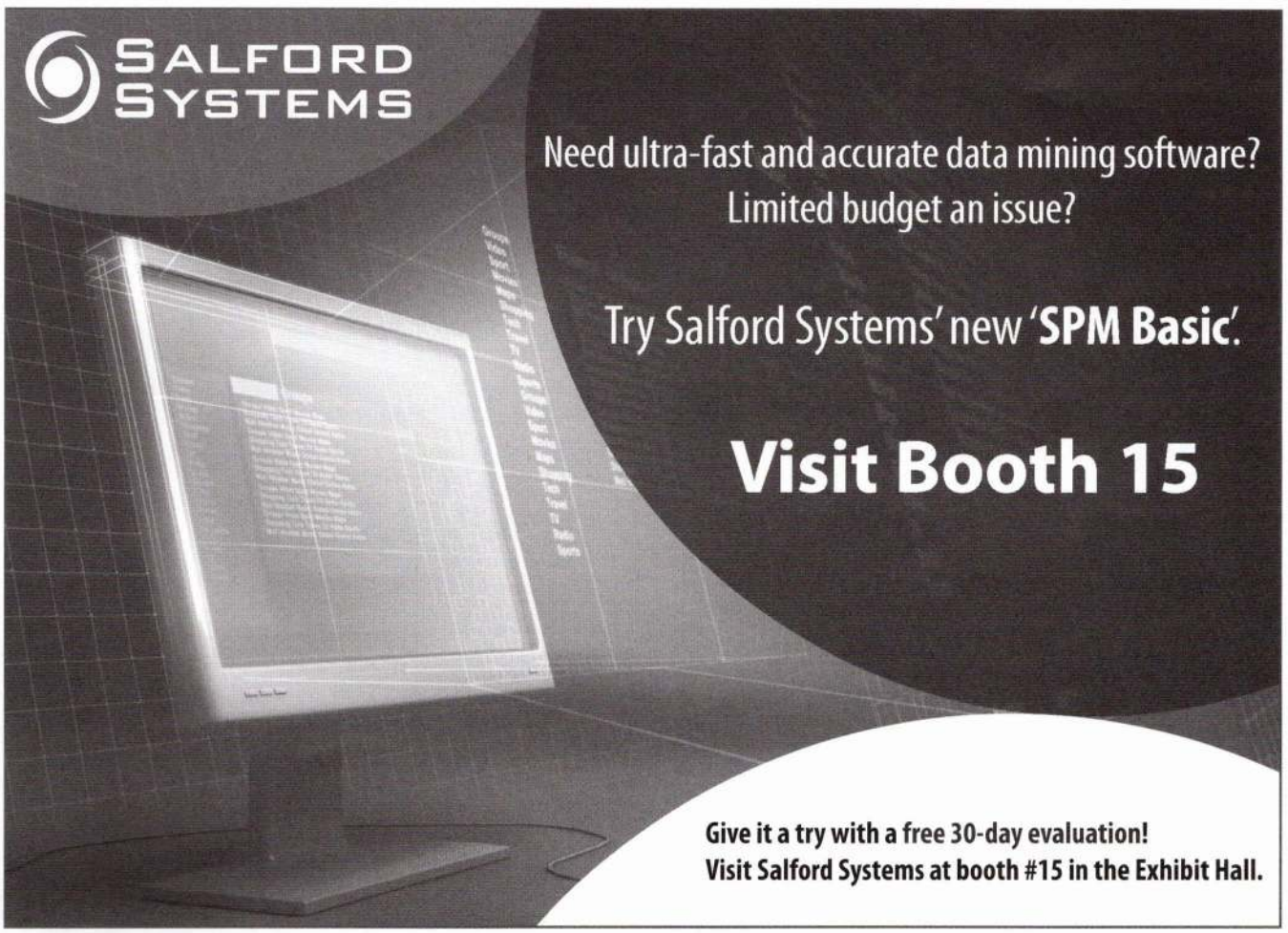
Keynote: Caryl Brzymialkiewicz	C – West 301A	10:00am-10:50am
Keynote: 2012 Wagner Prize Presentation	C – West 101	10:00am-10:50am
Plenary-Joint with SMDM: Mark Roberts Panel	C – West 301A	5:00pm-5:50pm

WHERE TO GO FOR LUNCH

Metro Marché Food Court
North building of the Convention Center, Street Level
Bistro on Third
City Center Coffee
Crust
Tortillas Mexican Grill
Urban Wok

Hyatt Hotel
Einstein Brothers Café
Networks Bar & Grill

Renaissance Hotel
Marston's Cafe



Mobile App, INFORMS TV, Online Tools

FIRST FOR INFORMS CONFERENCE – MOBILE APP

For this year's annual meeting and in collaboration with Wiley, INFORMS is offering a free web-based mobile app for smart phone and tablet users. Use the app to access conference information on the go, including the schedule of sessions and talks, plenary/keynote information, maps of meeting locations, exhibit details, links to Wiley and INFORMS journal information, and more.

Download the app at www.INFORMSPhoenix2012.org, following the instructions on the opening screen. Once the web app has been loaded onto your smart phone or tablet, it should work even when you don't have an internet connection (except for the links to websites in the "Links" section). If your device prompts you to connect to the internet when opening the app and no connection is available, you may safely ignore it and continue to access the app. Please note that agenda updates require connectivity to the internet.

This app represents INFORMS's first venture into the world of mobile web applications. Stop by the INFORMS booth (#58-60) to get some advice. Unfortunately we will be unable to provide technical support during the meeting, but we would like to hear any feedback you may wish to offer so that we may improve the application for future meetings. Use the free conference mobile app to:

- **Build your personal daily schedule** - Plan your day by selecting sessions from the daily schedule. You can also add custom personal events for meetings with exhibitors.
- **Engage and network** - Share information about the conference via Twitter, Facebook, LinkedIn, and more!
- **Find what you are looking for** - Use the search functionality and interactive maps to find sessions and exhibitors (e.g., Wiley at Booth #21) more easily.
- **Take notes** - Make the most of your app and take notes about sessions, speakers, and exhibitors right in their profile. At the end of the event, you can easily export all notes via email.
- **Access must-have research** - Stay on the cutting-edge and be in the know with free content from Wiley and INFORMS. You can access articles from the *Wiley Encyclopedia of Operations Research and Management Science*, as well as from the Wiley journals, *International Transactions in Operational Research* and *Decision Sciences*. Informative RSS feeds from 13 INFORMS journals are available, including *Management Science, Operations Research*, and *Decision Analysis*. And, you can sample content from the *INFORMS TutORials in OR* series, featuring 10 of the 14 tutorials being presented during the conference.

THANK YOU
WILEY

INFORMS TV – ANOTHER NEW CONFERENCE FEATURE

Tune in to INFORMS TV during the meeting to catch the latest conference highlights, enjoy "behind the scenes" interviews with meeting speakers and INFORMS leaders, and hear reactions and interviews with attendees like you. Each day's broadcast will combine coverage of conference events with "thought leadership" segments that feature eight different organizations.

The overall goal of INFORMS TV is to raise the visibility of best practices in operations research and management sciences, as well as to highlight collaborations between diverse institutions including research institutions, universities, and private sector organizations. Programs from these organizations will be featured in the broadcasts:

- Carnegie Mellon University
- InterContinental Hotels Group
- Lockheed Martin
- Naval Postgraduate School
- Northeastern University
- Purdue University
- University of Alabama
- University of Louisville

Where and when to tune in:

- Check out the video displays in the registration area/exhibit hall and in the Interactive Session foyer.
- If you are staying at the Hyatt or Renaissance, you can view the next day's broadcast beginning at 7:00pm the evening before.
- The team from WebsEdge Production will begin filming on Sunday. The first broadcast will be aired at the Hyatt and Renaissance beginning at 7:00pm on Sunday evening, and then continue all day Monday. The Monday coverage will air on Tuesday, and the Tuesday coverage will air on Wednesday.

ENGAGE WITH ONLINE TOOLS

http://meetings2.informs.org/phoenix2012/

Blogs
Visit the Annual Meeting website during the meeting for commentary from your friends and colleagues. Blogs will be posted to the website before, during and after the meeting. Be sure to check back frequently for new posts.

Tweets
All attendees are invited to share what they are doing and seeing in real time. Remember to add hashtag "#informs2012" to your tweets, and they will appear on the Annual Meeting homepage during the meeting. Be sure to pick up your "Tweeter" ribbon. Also "follow" the official conference twitter feed, @INFORMS2012, to make sure you receive important conference announcements. All tweets appear on a large monitor near registration.

LinkedIn
Connect with other attendees on the Annual Meeting LinkedIn Group to discuss key topics. RSVP to the LinkedIn Meeting Event to let your colleagues know you are attending. Go to the Annual Meeting website homepage to find a link leading to the Annual Meeting LinkedIn group.

Pinterest
Visit our Pinterest Annual Meeting Board to view a collection of fun things to do and see while visiting Phoenix. http://pinterest.com/informs/2012-informs-annual-meeting-phoenix/

Photos and Video
Attendees are encouraged to take photos and video at the meeting; send your photos to photosand video@mail.informs.org and we'll post them on the Annual Meeting website

eNews Daily
INFORMS is publishing the fifth volume of its popular *Annual Meeting eNews Daily* in Phoenix. This official record of the Annual Meeting is delivered each day to your in-box, providing a recap of the previous day's happenings and a preview of the upcoming day's can't-miss events. There are links to each issue on the Annual Meeting website.

Podcasts
Liven up your travel to and from the INFORMS Annual Meeting by bringing along an INFORMS podcast for the road. Download a podcast at www.scienceofbetter.org/podcast.

Business, Receptions and Networking...All Welcome!

SUNDAY, OCTOBER 14

Information Systems	R – Salon 2	5:45pm-6:30pm
Aviation Applications	C – West 103A	6:15pm-7:15pm
Data Mining & Artificial Intelligence	C – West 104A	6:15pm-7:15pm
Energy, Natural Resources & Environment	C – North 232B	6:15pm-7:15pm
Forum on Education (INFORM-ED)	C – West 105B	6:15pm-7:15pm
Location Analysis	C – North 226A	6:15pm-7:15pm
Manufacturing & Service Ops. Mgt.	C – North 224	6:15pm-7:15pm
Military Applications Board	C – North 231C	6:15pm-7:15pm
Minority Issues Forum	C – North 226C	6:15pm-7:15pm
Optimization	C – North 229A	6:15pm-7:15pm
Railway Applications	C – North 228A	6:15pm-7:15pm
Service Science	C – North 226B	6:15pm-7:15pm
Simulation	C – West 103B	6:15pm-7:15pm
Telecommunications	C – West 106C	6:15pm-7:15pm
Transportation Science & Logistics Board	C – North 230	6:15pm-7:15pm
Decision Analysis Council	C – West 102A	6:15pm-7:30pm
Revenue Management & Pricing Board	C – North 225A	7:15pm-8:15pm

MONDAY, OCTOBER 15

Public Programs, Service & Needs	H – Regency D	12:30pm-1:30pm
Decision Analysis	C – West 102A	6:00pm-7:15pm
Technology Management	C – West 106B	6:00pm-7:15pm
Analytics Section	C – North 224B	6:15pm-7:15pm
Applied Probability	C – West 106A	6:15pm-7:15pm
Computing	C – West 105B	6:15pm-7:15pm
eBusiness	C – West 106C	6:15pm-7:15pm
Financial Services	C – West 105C	6:15pm-7:15pm
Health Applications	C – West 104B	6:15pm-7:15pm
Military Applications	C – North 231C	6:15pm-7:15pm
Multiple Criteria Decision Making	C – West 105A	6:15pm-7:15pm
Quality, Statistics & Reliability	C – West 103A	6:15pm-7:15pm
Revenue Management & Pricing	C – North 225B	6:15pm-7:15pm
Spreadsheet Productivity Research	C – North 227B	6:15pm-7:15pm
Transportation Science & Logistics	C – North 229	6:15pm-7:15pm
Women in OR/MS	C – North 228A	6:15pm-7:15pm
Behavioral Operations Management	C – West 102B	7:15pm-8:15pm
Military Applications Reception	C – North 231C	7:15pm-10:15pm

TUESDAY, OCTOBER 16

CPMS Council	H – Cassidy	7:00am-9:00am
SpORts	C – West 106C	6:00pm-7:00pm

KEY
C-Convention Center
H-Hyatt
R-Renaissance

Speakers Book Store at INFORMS Booths

The INFORMS Speakers Bookstore will feature recent publications written by a number of this year's INFORMS Annual Meeting presenters. Stop by the INFORMS booths #58-60 in the Exhibit Hall to check out a wide selection of titles.

WIN AN iPAD2!

You can get into the running to win an iPad2 just by visiting the exhibits. INFORMS will award one iPad during each afternoon coffee break in the Exhibit Hall on Monday and Tuesday. Just follow these easy steps:

- Stop by one of the exhibit booths to pick up a raffle coupon (different color coupon for each day).
- Fill out the coupon and get it stamped by the exhibitor.
- While you're at the booth, give the exhibitor an opportunity to tell you about their company's products!
- Place your completed coupon in the raffle bin.
- Be present when the winning raffle ticket is drawn.
- You can submit as many coupons as you like, but each must be from a different exhibitor.

Schedule:

- Submit your coupon by 4:15pm in the Exhibit Hall.
- Drawing is at 4:15pm during the coffee break (4:00-4:30pm). Location in the Exhibit Hall will be announced–watch for signs in the Exhibit Hall.

NOTE: there is a different coupon for each day. Only coupons for that day will be eligible. You can submit as many coupons as you like, but each must be from a different exhibitor.

Find the Latest in **Operations Research & Management Science Publications**

Stop by the Wiley Booth# 21 to check out new titles in the field!

Receive a **20%** Conference Discount on all Books

Wiley Encyclopedia of Operations Research and Management Science, 8 Volume Set

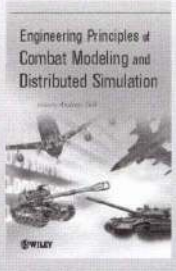
James J. Cochran, Louis Anthony Cox, Jr., Pinar Keskinocak, Jeffrey P. Kharoufeh, J. Cole Smith

978-0-470-40063-0 • Hardcover • Mar 2011 • 6,408 pgs • List price: $2,800.00



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INFORMSPhoenix2012.org



Engineering Principles of Combat Modeling and Distributed Simulation

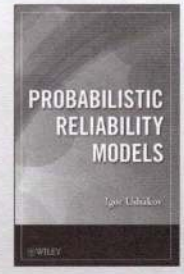
Edited by Andreas Tolk

978-0-470-87429-5

Hardcover • Mar. 2012 • 936 pgs

List price: $135.00

Conference price: $108.00



Probabilistic Reliability Models

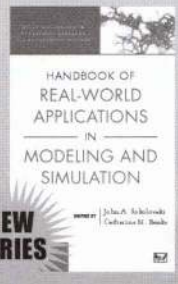
By Igor Ushakov

978-1-1183-4183-4

Hardcover • Sept. 2012 • 248 pgs

List prince: $94.95

Conference price: $75.96



Handbook of Real-World Applications in Modeling and Simulation

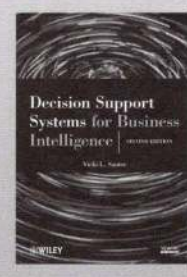
Edited by John A. Sokolowski and Catherine M. Banks

978-1-1181-1777-4

Hardcover • Apr. 2012 • 352 pgs

List prince: $149.95

Conference price: $119.96



Decision Support Systems for Business Intelligence

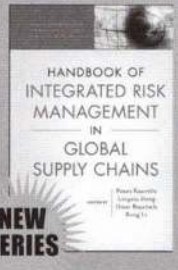
By Vicki L. Sauter

978-0-470-43374-4

Paperback • Feb. 2011 • 453 pgs

List prince: $121.00

Conference price: $96.80



Handbook of Integrated Risk Management in Global Supply Chains

Edited by Panos Kouvelis, Linqxiu Dong, Onur Boyabatli, and Rong Li

978-0-470-53512-7

Hardcover • Nov. 2011 • 624 pgs

List prince: $150.00

Conference price: $120.00



Service Science

By Mark S. Daskin

978-0-470-52588-3

Hardcover • Dec. 2010 • 636 pgs

List prince: $137.00

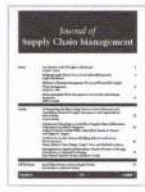
Conference price: $109.60

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WILEY

SPEAKER GUIDELINES

Audio/Visual Equipment

All session rooms will be equipped with a computer projector, but please note that you must provide your own laptop or pre-arrange to share with others in your session. Please follow these guidelines to ensure a successful presentation:

- Bring your laptop to your session. We recommend that you pre-arrange with other speakers in your session to ensure that at least one of you brings a laptop from which you can project your talks.
- Bring a power adaptor with you. We recommend that you do not attempt to run your presentation off the laptop battery.
- If your laptop is not compatible with AC power, please bring an electrical adaptor so that you can connect to U.S. electricity.
- If your laptop is a Mac, you will need the appropriate adapter for the external video output.
- Arrive at your session at least 15 minutes before it begins. All presenters in a session should set up and test the connection to the projector before the session begins.
- We encourage speakers to put their presentations on a USB flash drive as a backup.

Speaker Ready Room

There will be a Speaker Ready Room available in the Convention Center, Exhibit Hall, West Ballroom BCD, during the meeting. You can stop by and practice connecting your laptop to the projector. We will also have quick instructions at each session room and technical assistance available for any problems.

Presentation Guidelines

The room and location of your session are listed in the Technical Sessions section and in the Master Track Schedule. Please be on time for your session and check in with the session chair. Presentations should be limited to key issues with a brief summary. Time your presentation to fit within your designated time span and leave an opportunity for questions and audience participation. INFORMS does not produce proceedings with complete papers. To obtain complete copies of any papers abstracted in the program, please contact the authors directly at the addresses supplied with each abstract.

For Questions about the Program: Program Information Desk

If you have general questions about the meeting and/or questions about your own presentation, stop by the Program Information Desk located in the Convention Center, near INFORMS Registration in West Ballroom BCD. We ask Session Chairs to notify the Information Desk about any last-minute changes or cancellations; these changes will be posted outside the meeting rooms.

For Assistance during Your Session: Session Monitor Desks

Session Monitor Desks are located in several areas in the Convention Center and the Hyatt (see maps on pages 42-43 for specific locations). If you have a problem in your session room related to AV needs or any other requests, go to the Session Monitor Desk in the area to ask for assistance.

Courtesy to Fellow Speakers

Attendees are asked to be respectful of their colleagues by turning off cell phones and mobile devices before the presentations begin. In addition, please note that use of cameras and all recording devices is prohibited during sessions unless you have received prior permission from the speaker.

SESSION CHAIR GUIDELINES

The role of the Chair is to coordinate the smooth running of the session. The Chair:

- Begins and ends the session on time. Each session lasts 90 minutes, with the time per presentation determined by the number of papers in the session. Equal time should be given to each paper.
- Introduces each presentation (just the title of the paper and the name of the presenting author).
- Ensures that presentations are made in the order shown in the program. This allows for "session jumping." If a speaker cancels or does not attend, the original time schedule should be adhered to rather than sliding every talk forward.
- Completes the session attendance forms (forms will be in the room).
- Reminds the audience to (a) turn off all mobile devices and (b) that photography is not allowed without the prior permission of the speaker.

THANK YOU

Conference Bag Sponsor

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Established in collaboration with MIT

Badge Holder Sponsor

AIMMS

EXHIBITS

Name badges must be worn for admittance to the Exhibit Hall, located in the Convention Center, West Ballroom BCD, during the following hours:

Sunday, Oct. 14	12:00pm-5:00pm
(Welcome Reception)	7:30pm-9:00pm*
Monday, Oct. 15	9:00am-5:00pm
Tuesday, Oct. 16	9:00am-5:00pm
Wednesday, Oct. 17	9:00am-1:00pm

*The Exhibit Hall is open Sunday evening for a gala Welcome Reception. All registrants are invited to the reception for the chance to meet colleagues and renew acquaintances.

INTERNET ACCESS

Convention Center: free wireless Internet and an email center are located in the Exhibit Hall in the Convention Center, at the back of the hall. There are a limited number of computers available in the email center if you do not have your own computer. Name badges must be worn for admittance. The Email Center will be open during the following hours:

Sunday, Oct. 14	7:00am-5:00pm
Monday, Oct. 15	7:00am-5:00pm
Tuesday, Oct. 16	7:00am-5:00pm
Wednesday, Oct. 17	7:00am-3:00pm

Hyatt: there is complimentary wireless in the Atrium Lobby, where coffee breaks are located.

BUSINESS CENTERS

Convention Center: there are two UPS stores: one on the exterior of the West building on 2nd Street and another inside of the North Building (3rd Street) on the first floor. The stores are open Monday-Friday 7:00am-6:00pm, Saturday, 8:00am-2:00pm.

Hyatt: the VIA Business Lounge is a self-serve business center, located in the lobby. Non-guests have access with their credit card.

REGISTRATION

Badges Required for Technical Sessions
INFORMS Annual Meeting 2012 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. All attendees, including speakers and session chairs, must register and pay the registration fee. Lost badges can be replaced at the registration desk for a fee of $5.

Registration Fee
Your registration fee includes admittance to the complete technical program, the Exhibit Hall, Email Center and most special programs. The following social/food events are also included: Sunday evening Welcome Reception, Sunday evening Awards Ceremony, Tuesday evening General Reception, and all morning and afternoon coffee breaks. No other meals are included.

Guest Registration
If your guest would like to accompany you to the major social events, you can purchase a guest registration ($75) that covers admission to the Sunday Welcome Reception, Sunday Awards Ceremony and Tuesday General Reception. Guests are not eligible to attend the technical sessions. Go to the Registration Desk to register your guest.

25+ Year Member Ribbon
If you have been an ORSA-TIMS-INFORMS member for 25 or more years, please stop by the INFORMS booths (#58-60 in the Exhibit Hall) to pick up a special ribbon designating your 25+ year membership. We salute our long-time members!

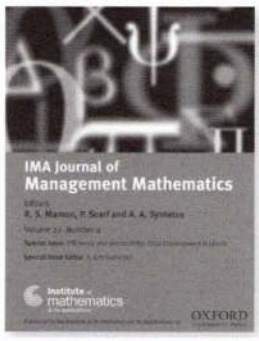
OTHER SERVICES

Luggage Check
A luggage check area will be located in the Convention Center near INFORMS Registration. The luggage check will be open on Tuesday, 7:00am-6:30pm and Wednesday, 7:00am-6:30pm.

Phoenix Visitor Information
The Convention Center has two information desks: one in the West building lobby and another in the North building lobby. Both desks can help with tourist information, and also have venue hosts who can assist with directions both in the building as well as general information on Phoenix.

EXCELLENCE IN EVIDENCE

IMA JOURNAL OF MANAGEMENT MATHEMATICS
Edited by Rogemar S Mamon, Philip Scarf and Aris A Syntetos



The mission of the *IMA Journal of Management Mathematics* is to publish original, high quality mathematical research that will have a significant impact on the theory and practice of business, finance, management, and policy making.

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GUEST PROGRAM

The program for registered guests includes the Sunday Welcome Reception and Awards Ceremony, and the Tuesday evening General Reception. Registered guests will receive a colored name badge that must be worn for admittance to these events. Guests are not eligible to attend the technical sessions. Guest registration is $75 - go to the INFORMS Registration Desk to register your guest.

GUEST TOURS

You may still be able to register for the following guest tour. Go to the INFORMS Registration Desk for information on availability.

Downtown Phoenix Walking Tour
Sunday, October 14
8:00am-10:30am, $10.00
Get acquainted with Phoenix and some of your fellow INFORMS guests on this 75-minute walk around downtown, guided by one of Phoenix's Downtown Ambassadors, who will share some of the history, art and culture of America's fifth largest city (and largest state capital!). The walk will end with coffee and muffins at a local bakery café. Following the walk you will have the opportunity to get advice from the Ambassador about other activities available to you in downtown Phoenix. Meet the Phoenix Downtown Ambassador at the Hyatt lobby for tour departure.

Additional Tours
Southwest Discovery Tours is providing INFORMS guests with a variety of local tours, including the Grand Canyon, Sedona, Sonoran desert, Musical Instrument Museum and more. There may be limited availability for some of the tours. Stop by the Southwest Discovery Tours booth, located near INFORMS registration, to check availability.

PLANT TOURS

No on-site registration is available for the following plant tours. **If you have registered in advance, meet in the Convention Center at the pull-in area in front of the North building on 3rd Street** (located closest to Washington Street). Buses will leave at the beginning time listed for each tour, and will return to the Convention Center at the ending time listed.

Mayo Clinic Multidisciplinary Simulation Centers (MSC), Arizona Tour
Monday, October 15
9:00am-12:00pm

Santan Generating Station
Tuesday, October 16
9:00am-12:15pm

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INFORMS Booth #58
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800.4.INFORMs (800.446.3676)
E-Mail: informs@informs.org

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It's 2013 INFORMS membership renewal time! We hope you'll stay with us. Online renewals available at **https://renew.informs.org**

Networking & Social Events

SATURDAY, OCTOBER 13

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Hyatt – Regency AB
The INFORMS Board of Directors encourages all members to bring their ideas, opinions and suggestions to this annual meeting. Current business and future directions for INFORMS are on the agenda. Wine and cheese will be served.

SUNDAY, OCTOBER 14

INFORMS Online & Social Networking Reception
6:00pm-7:00pm
Hyatt – Cassidy
What's your social networking strategy for yourself or for INFORMS? We invite all contributors to IOL (the INFORMS website) and INFORMS social networking sites to come and meet face to face. Join us for refreshments and drinks - we are your INFORMS Online community!

Minority Issues Forum Reception
8:00pm-9:00pm
Hyatt – Cowboy Artists
Come meet old friends and make new ones while talking about minority issues and other intellectual issues and opportunities. Posters submitted to the Minority Issues Forum Poster Competition will be on display during the reception.
Sponsored by North Carolina State University, Edward P. Fitts Dept. of Industrial & Systems Engineering; Clemson University, Dept. of Industrial Engineering; Cornell University, School of Operations Research & Information Engineering; Carnegie Mellon University, Heinz College; North Carolina A&T State University, Dept. of Industrial & Systems Engineering

NEW MEMBER WELCOME & ANNUAL MEETING ORIENTATION SESSION

Sunday, 4:30pm-5:30pm
Hyatt – Regency C

Don't miss this informative session. All new members and first-time meeting attendees are invited to attend. The session will feature a brief presentation on member benefits, including communities, from key INFORMS leaders, an orientation to navigating the meeting, and a chance to network with colleagues by technical interest, geographic location or other professional interest.

MONDAY, OCTOBER 15

COIN-OR Members & Users Meeting - Bag Lunch
12:15pm-1:15pm
Center – West 212B
Anyone interested in open-source software tools, open standards, and data and model repositories for any aspect of operations research is encouraged to attend this Computational Infrastructure for OR (COIN-OR) meeting. Please bring your own lunch and ideas. For more information, visit www.coin-or.org.

Junior Faculty Interest Group Luncheon
12:30pm-1:30pm
Offsite – Kincaid's Classic American Restaurant, 2 South Third St., Phoenix
$25 ($15 students) -*A limited number of tickets may be available on-site. Go to the INFORMS registration desk for information on availability. No tickets will be sold at the door.*
The winners of the 2012 JFIG Paper Competition will be presented with awards. All junior faculty are invited to participate. This event gives junior faculty in engineering and business schools the opportunity to discuss career development and exchange ideas.
Sponsored by University of Arkansas and Witchita State University, Dept. of Industrial Engineering.

SPPSN Lunch
12:30pm-1:30pm
Hyatt – Regency D
$10 - Section member ($15 nonmember) - *A limited number of tickets may be available on-site. Go to the INFORMS registration desk for information on availability. No tickets will be sold at the door.*
This lunch and business meeting is open to members of the INFORMS Section on Public Programs, Service and Needs and also those who are interested in joining the section.
Sponsored by Georgia Tech, School of Industrial and Systems Engineering.

CPMS Isolated Practitioner Workshop & Reception
6:15pm-7:15pm
Center – North 225A
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. This 29th workshop will address timely issues that affect isolated practitioners. All are welcome to participate. Wine and cheese will be served.

Student Awards Ceremony & Student Reception
Awards Ceremony: 7:30pm-8:00pm
Reception: 8:00pm-9:30pm
Hyatt – Regency A
All students registered for the meeting are invited to attend the first-ever Student Awards Ceremony. The Chapters/Fora Committee will present the winners of the Student Chapter Annual Awards and the Judith Liebman Awards. Join us to recognize the great contributions of our most dynamic student volunteers. Plan to stay for the Student Reception, which immediately follows the ceremony.

The reception that follows the Awards Ceremony is open to all students – join us for an evening of food and drink, fun and networking. Come relax after a busy day of sessions and mingle with fellow students from universities around the world.

THANK YOU

THE SETH BONDER FOUNDATION

TUESDAY, OCTOBER 16

Women in OR/MS Forum Luncheon
12:30pm-1:30pm
Hyatt – Regency C
$18 ($8 students) – *A limited number of tickets may be available on-site. Go to the INFORMS registration desk for information on availability. No tickets will be sold at the door.*
All those interested in issues related to women professionals in OR/MS are invited to join us.

Sponsored by Georgia Tech, Stewart School of Industrial & Systems Engineering; SAS, Inc.; Texas A&M University, Dept. of Industrial & Systems Engineering; University of Alabama, College of Business; University of Massachusetts, Isenberg School of Business; University of Arizona, Systems & Industrial Engineering; Northwestern University, Dept. of Industrial Engineering & Management Science; Virginia Commonwealth University, Dept. of Statistical Sciences & O.R; University of Texas-Arlington; Penn State University-Erie; University of Texas-Austin, Operations Research & Industrial Engineering.

YOUR BADGE IS YOUR TICKET

Wear your badge for admission to these events; your meeting registration fee includes these special receptions. If your guest would like to accompany you, a guest registration must be purchased (guests will receive a special badge). The $75 guest fee includes the Sunday Welcome Reception, Sunday Awards Ceremony and the Tuesday General Reception.

SUNDAY

WELCOME RECEPTION & EXHIBITS

7:30pm-9:00pm
Convention Center – Exhibit Hall, West 301

INFORMS and the Phoenix Organizing Committee welcome you to the 2012 Annual Meeting with an evening of fellowship and fun. The Welcome Reception is the perfect venue to meet with colleagues and visit the exhibits. Light snacks will be served. Soft drinks are complimentary, with a cash bar for other beverages.

INFORMS AWARDS CEREMONY & DESSERT RECEPTION

8:30pm-9:45pm (Doors close at 8:45pm*)
Convention Center- West 101

The INFORMS Board of Directors invites you to honor and celebrate the achievements of our colleagues at the annual Awards Ceremony. You can attend the Welcome Reception first and then take the escalators down to Level 1 for the Awards Ceremony. Following the ceremony, you'll have an opportunity to congratulate the awardees at a special dessert reception.

*Please note that the reception is part of the ceremony event, open to the awardees, their friends and colleagues, and all those who attend the Award Ceremony itself. We are sorry we cannot accommodate guests to the reception who do not also attend the ceremony.

These prestigious awards will be presented during the ceremony:

INFORMS Expository Writing Award
The late Uriel G. Rothblum, Technion-Israel Institute of Technology

INFORMS President's Award
Andrés Weintraub, Universidad de Chile

INFORMS Prize for the Teaching of ORMS Practice
David Rogers, University of Cincinnati

George E. Kimball Medal
Susan Albin, Rutgers University
Don N. Kleinmuntz, Strata Decision Technology, LLC

John von Neumann Theory Prize
George L. Nemhauser, Georgia Institute of Technology
Laurence A. Wolsey, Université Catholique de Louvain

INFORMS Impact Prize
The 2012 awardees are the primary originators of the five most important algebraic modeling languages:

Johannes Bisschop, AIMMS and GAMS
Kevin Cunningham, LINDO/LINGO
Robert Fourer, AMPL
David M. Gay, AMPL
Brian W. Kernighan, AMPL
Bjarni Kristjansson, MPL
Alexander Meeraus, GAMS
Linus Schrage, LINDO/LINGO

Bonder Scholarship for Applied Operations Research in Health Services
Amin Khademi, University of Pittsburgh

Bonder Scholarship for Applied Operations Research in Military Applications
Mehmet Ertem, University of Wisconsin-Madison

Four student awards will also be announced during the ceremony: the George E. Nicholson Student Paper Competition, the George B. Dantzig Dissertation Prize, the Doing Good with Good O.R. Student Competition, and the INFORMS Undergraduate Operations Research Prize.

THANK YOU

GAMS

TUESDAY

GENERAL RECEPTION GET YOUR KICKS ON ROUTE 66

7:30pm-10:00pm
Convention Center- North Ballroom, Level 1 (Steet level)

It began in 1926 as a roadway to bridge Chicago and the coast of California -- a two-lane highway that rolled through Arizona and the vast Southwest, winding 2,400 miles through eight states and ending at the Santa Monica pier. In the 1930s, Dust Bowl victims of the Depression traveled Route 66 to forge new lives in California; in the 1950s and 60s, American families made it their preferred route to see the country. Route 66 became famous for its quirky roadside attractions, including teepee-shaped motels, frozen custard stands, Indian curio shops and reptile farms. It has been memorialized and celebrated in songs, a hit TV series, and – most recently – Pixar's animated film, *Cars*.

You can travel the famous road yourself at our Tuesday General Reception. We'll have our own quirky and fun things to do: a teepee putting hole, tequila bowling, tomahawk toss and beach ball basketball. The Rave, a classic rock band, will showcase a broad spectrum of musical styles, from pre-50s to current hits, including soul, Motown, blues and country.

And, of course, we'll be serving up a hearty menu that features food from stops along the highway – including St. Louis style ribs, Arizona vegetarian fajitas, New Mexican three-cheese enchiladas, Texas beef strip steaks, California avocado salad and topped off with a great Oklahoma pecan pie!

THANK YOU

ASU
ARIZONA STATE UNIVERSITY



Saturday Workshops

DM-HI WORKSHOP

7th INFORMS Workshop on Data Mining and Health Informatics

Space may be available in this workshop. A separate fee is required, and you can inquire about availability at the INFORMS registration desk located in the Convention Center.

Breakfast/Welcome Session
8:30am-9:00am – Hyatt, Borein

Workshop
9:00am-5:30pm – Hyatt, Remington & Russell

The theme of the workshop centers on health informatics. The Data Mining (DM), Artificial Intelligence (AI) and Health Informatics (HI) sections of INFORMS are jointly organizing this workshop. The DM, AI and HI sections are interdisciplinary communities that bring together researchers and practitioners in science, engineering and business who are interested in the theories, applications and methodologies of DM, AI and HI. This workshop highlights the frontiers of fundamental and applied research in DM, AI and HI.

VENDOR WORKSHOPS

All Vendor Workshops are located in the Hyatt Phoenix. Free to registered meeting attendees. Walk-ins accepted as long as space is available.

9:00AM - 11:30AM

AnyLogic
Introduction to AnyLogic Software Basics
Phoenix East

McGraw-Hill Game-Based Learning
McGraw-Hill's Practice Operations
Cowboy Artists

SAS Global Academic Program
Querying and Reporting using SAS Enterprise Guide
Phoenix West

Spry, Inc.
Agile Business Intelligence: Integrating Data Without IT
Suite 312

12:00PM - 2:30PM

AIMMS (Paragon Decision Technology)
Experience AIMMS
Suite 322

American Optimal Decisions
Portfolio Safeguard (PSG): Advanced Nonlinear Mixed-Integer Optimization Package
Suite 324

Gurobi Optimization
Recent Improvements in the Gurobi Optimizer
Phoenix East

JMP Software from SAS
Predictive Analytics with JMP 10 Pro
Phoenix West

Lumina Decision Systems
Decision Analytics: From Big Data to Clear Decisions with Analytica
Suite 312

Maximal Software, Inc.
Deploying MPL Optimization Models on Tablet Computers and Mobile Platforms Business Applications
Suite 314

Palisade Corporation
Risk & Decision Assessment using @RISK
Suite 316

Tableau Software
Dynamic Data Visualization
Cowboy Artists

3:00PM - 5:30PM

FICO
FICO® Xpress Optimization Suite
Phoenix East

Frontline Systems, Inc.
Data Mining, Simulation and Optimization in Excel and the Cloud
Suite 312

GAMS Development Corp.
Fundamentals and Recent Developments of the GAMS System
Suite 314

IBM ILOG Optimization
IBM Advanced Analytics and Optimization Forum
Cowboy Artists

Imagine That, Inc.
ExtendSim Simulation Software
Suite 316

LINDO Systems, Inc.
The Difficult Task of Making Optimization Easy
Suite 322

Salford Systems
Introduction to Data Mining and Real-World Data Analysis
Suite 324

SAS
Solving Business Problems with SAS Analytics and OPT-MODEL
Phoenix West

This joint program is open to all INFORMS Annual Meeting and SMDM Annual Meeting attendees at no additional charge. The program is held in conjunction with the Society of Medical Decision Making, followed by the SMDM Annual Meeting, October 17-20, taking place at the Hyatt Hotel.

WEDNESDAY, OCTOBER 17

JOINT SESSIONS

1:30-3:00pm
WC19
C-West 211A
Implementing OR/IE/MDM in Practice
Chaired by Sheldon Jacobson, University of Illinois, with co-chair Dominick Frosch, Palo Alto Medical Foundation. Featuring presentations by Murray Côté, Texas A&M Health Science Center; Glyn Elwyn, Dartmouth Center for Healthcare Delivery Science; Diwakar Gupta, University of Minnesota; and Elissa Ozanne, UCSF Medical Center.

WC20
C-West 211B
Operations Research for Public Health
Chaired by Margaret Brandeau, Stanford University, with co-chair James Stahl, Massachusetts General Hospital. Featuring presentations by Douglas Owen, VA/Stanford; David Meltzer, University of Chicago; Michael Carter, University of Toronto; and Itai Ashlagi, Massachusetts Institute of Technology.

3:20pm-4:50pm
WD19
C-West 211A
Decision Analytic and Patient-Centered Modeling in Medicine
Chaired by Jagpreet Chhatwal, University of Pittsburgh, with co-chair Jeremy Goldhaber-Fiebert, University of Pittsburgh. Featuring presentations by Mark Roberts, University of Pittsburgh; Y. Claire Wang, Columbia University; Ahmed Bayoumi, University of Toronto; and Turgay Ayer, Georgia Institute of Technology.

WD20
C-West 211B
Healthcare Operations Management
Chaired by Pinar Keskinocak. Georgia Institute of Technology, with co-chair Joel Tsevat, University of Cincinnati. Featuring presentations by James Stahl, Massachusetts General Hospital; Andrew Schaefer, University of Pittsburgh; and Martin Puterman, University of British Columbia.

SMDM PLENARY

5:00pm-5:50pm
C-West 301A
Panel: What Pilots and the Airline Industry can Teach Clinicians and Hospitals about Patient Safety
Moderator: Mark Roberts, University of Pittsburgh

The airline industry has made tremendous advances in the safety of aviation over the past 30 years, and has successfully ingrained a culture of safety into operations. As reported by the Robert Wood Johnson Foundation, the formation of the Commercial Aviation Safety Team in the mid 1990s has reduced several types of airline fatalities to near zero. Unfortunately, after the landmark To Err Is Human report by the Institute of Medicine noted huge numbers of patients are harmed and die as a result of errors, no similar improvement has been witnessed in health care patient safety. This panel will explore how the successes of safety improvement in aviation can be translated into health care.

Arnold Barnett, PhD, is the George Eastman Professor of Management Science and a Professor of Statistics at the MIT Sloan School of Management. An INFORMS fellow, he is one of the world's leading experts on airline safety, who has contributed significantly to the development of the safety culture in the airline industry.

Brent James, MD, MStat, is the Chief Quality Officer, and Executive Director, Institute for Health Care Delivery Research at Intermountain Healthcare, in Salt Lake City, Utah. He has been an international leader in patient safety and quality improvement for nearly 30 years, and was a co-author on many of the IOM reports which have compared patient safety and airline safety.

Mark S. Roberts, MD, MPP, Professor and Chair of Health Policy and Management and the Graduate School of Public Health, University of Pittsburgh, a longstanding member of both INFORMS and SMDM, will moderate the session.

Whether you work in industry, government or consulting – whether you are doing descriptive, predictive or prescriptive analytics/O.R. work – you'll find the best applications resources at the INFORMS Annual Meeting.

ANALYTICS & PRACTICE TRACK

Sponsored by INFORMS Analytics Section and CPMS, The Practice Section of INFORMS
Track 23, C-West 212C
Plus other sessions in Tracks 17, 43 and 51
(see program for locations)
These tracks showcase O.R. and analytics in practice at a wide range of companies and organizations and feature outstanding, prize-winning presentations. In addition to the award and prize presentations, two roundtable panel sessions will consider current and potential applications of analytics to the intermodal industry. A panel on career management will address why advanced analytics are needed today more than ever. Another session explores an improved policy for the online retailer practice of multiple warehouses with centralized order fulfillment and inventory management. Management innovation in the US DoD and transformation of military supply chains is the topic of a tutorial.

Reprise of the 2012 Edelman Award-Winning Presentation: Supply Chain-Wide Optimization at TNT Express

Sponsored by CPMS, The Practice Section of INFORMS
Sunday: Keynote, 3:10pm-4:00pm
Center – West 301A
The Edelman Award competition – known as the "super-bowl" of applied O.R. and held at the INFORMS Conference on Business Analytics and O.R. – recognizes analytics projects that had major impacts on their client organizations. In this keynote, TNT Express tells how they implemented O.R., significantly improving decision-making quality and resulting in millions of Euros in cost savings.

2012 Edelman Finalists

Sponsored by CPMS, The Practice Section of INFORMS
Sunday-SB23 & SC23
Center – West 212C
These 2012 Edelman finalists – Carlson Rezidor Hotel Group, Intel Corp., Hewlett-Packard, and the Centers for Disease Control – will reprise presentations they delivered during the Edelman competition, showcasing high-impact results from analytics and O.R. Carlson Rezidor Hotel Group (in collaboration with JDA Software Group) shows how they maximized revenue through improved demand management and price optimization. Intel Corp. optimized capital investment decisions resulting in documented cost savings and at least $2B in revenue. Hewlett-Packard used O.R. to deliver profitable growth for HPDirect.com. The Centers for Disease Control teamed with operations researchers to devise sophisticated modeling and computational strategies to improve mass dispensing. For details on these presentations, see the listings for SB23 and SC23 on Sunday.

2012 Innovation in Analytics Award Competition

Sponsored by the Analytics Section of INFORMS
Competition: Tuesday, Track 23 (TA, TB, TC)
Center – West 212C
The purpose of the Innovation in Analytics Award is to recognize creative and unique developments, applications or combinations of analytical techniques. The prize promotes the awareness of the value of analytics techniques in unusual applications, or in creative combination to provide unique insights and/or business value. Competitors for 2012 include Ford (routing for battery electric vehicles), University of Illinois (examining the NCAA basketball tournament with advanced analytics), MIT & Con Edison (predicting manhole events), GfK Custom Research (analytics to set customer satisfaction priorities), University of Chicago (simultaneous learning from multiple patients), GE Global Research Center (whole-hospital operational forecasting system), IBM (insurance agency productivity), Texas Transportation Institute (optimizing acquisition of right-of-way), Nyenrode Business University (sustainable investment decision analysis), and University of Alberta (data-driven appointment scheduling in the presence of no-shows).

Reprise 2011 Winner & Finalist
Sponsored by the Analytics Section
Tuesday, Track 23 (TD 4:30pm-6:00pm)
Center – West 212C
The 2011 winner, Booz Allen Hamilton, will reprise their presentation on managing immigration and customs enforcement with innovative analytics. Finalist IBM will address service delivery modeling and optimization.

2012 Daniel H. Wagner Prize Competition

Sponsored by CPMS, The Practice Section of INFORMS
Competition: Monday, Track 23 (MA, MB, MC)
Center – West 212C
Award Presentation and Winner's Reprise Keynote
Wednesday, 10:00am-10:50am
Center – West 101
The Daniel H. Wagner Prize is awarded for a paper and presentation that describe a real-world, successful application of operations research or advanced analytics. The prize criteria emphasize innovative, elegant mathematical modeling and clear exposition. Competitors for the 2012 prize include the United States Coast Guard (for scheduling patrols in the Port of Boston), the City of Philadelphia (for redesigning City Council districts that minimize gerrymandering), Duke Cancer Institute (for improving patient access), Mount Sinai Medical Center (for optimizing bed assignments), Rush University Medical Center (for improving cervical cancer treatment), and Supply Chain Management (accounting for lead time variability, particularly in multi-echelon networks). The winner will be announced and will reprise their presentation at the Wednesday morning keynote session.

MORE ANALYTICS & PRACTITIONER SESSIONS

Software Demonstrations

Sunday-Wednesday
See pages 34-36 for abstracts and room locations.
Featuring applications you can use at work or in research. Learn about new product releases, case studies and software presented by leading vendors and solution providers.

Tutorials

Sunday-Wednesday
Track 16, Center – West 207
See pages 31-33 for abstracts.
These 90-minute sessions offer an in-depth look at current methodologies that parallel the theme of the 2012 meeting, Informatics Rising. Topics include humanitarian logistics, regenerating human parts for medical treatments, aggregate production planning, dynamic traffic flows, data mining of social media, optimization and analysis problems that compete in a game-theoretic sense, and more.

All attendees receive free access to the INFORMS 2012 *TutORials in Operations Research* online book concurrently with the meeting. For access, go to http://www.informs.org/Journal/Tutorials-in-OR/2012-TutORials-in-Operations-Research-ONLINE and enter your INFORMS member username and password. *Your username and password are printed on your conference registration receipt; you can also request that information when you go to the online*

tutorials site. You can order the 2012 book and previous volumes (CDs 2005-2009) through the TutORials website http://www.informs.org/Journal/Tutorials-in-OR. For more information, visit INFORMS booths #58-60 in the exhibit hall.

INFORMS Strategic Initiatives in Analytics
Monday, Track 17 (MB 11:00 am–12:30 pm)
Center – West 208B
INFORMS President-Elect Anne Robinson and Vice President of Practice Activities Jack Levis will provide information about multiple INFORMS analytics-related strategic priorities and goals in this talk. Topics such as certification, continuing education, and outreach will be covered.

CPMS Isolated Practitioner Workshop & Reception
Monday, 6:15pm-7:15pm
Center – North 225A
This special event is geared to the interests of isolated practitioners, the "Lone Rangers" of OR/MS. The 29th workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome; wine and cheese will be served.

INFORMS Analytics Section Business Meeting & Reception
Monday, 6:15pm-7:15pm
Center – North 224B
The Analytics Section invites all attendees to participate in the business meeting and reception. Enjoy light refreshments and listen to the officers discuss recent accomplishments of the section. Help chart the course for the future of the section.

Sponsored by SAS

Analytics Certification Reception
Tuesday, 6:15 – 7:15 pm
Hyatt – Regency A
Members of INFORMS Certification Task Force will make a short presentation and answer questions relating to INFORMS-conducted analytics certification to be launched in 2013.

SPECIAL PROGRAMS

2012 Combined Colloquia and Teaching Effectiveness Colloquium
Friday-Saturday
Hyatt - schedule and room locations on page 7.
The Teaching Effectiveness (TEC), Future Academician (FAC) and Future Practitioner (FPC) Colloquia begin their activities with a Friday evening dinner meeting, and continue a full-day Saturday program. Participation in the colloquia is by nomination only.
Sponsored by Omega Rho.

Organization Science: Dissertation Proposal Competition
Saturday, 8:30am-5:00pm
Hyatt – Suite 318
This competition is one of the most prestigious available to doctoral students studying organizations. Finalists present their dissertation proposals and receive detailed feedback from a panel of respected organizational scholars who act as judges.

CIST 2012 – Conference on Information Systems and Technology
Saturday-Sunday
Hyatt - schedule and room locations on page 7.
The goal of CIST is to engage academic and industry researchers in a dialogue that examines all aspects of theoretical and empirical research in information systems.
Sponsored by Carnegie Mellon University, Tepper School of Business; University of Maryland, Robert H. Smith School of Business; Carnegie Mellon University, H. John Heinz III College; Georgia Institute of Technology; Georgia State University; Indian School of Business, SRITNE; University of California at Davis; University of Minnesota; and Arizona State University.

INFORMS Fellows Luncheon
By invitation luncheon for INFORMS Fellows
Monday, October 15
12:45pm-2:30pm
Hyatt – Regency C

This luncheon honors INFORMS Fellows, examples of outstanding lifetime achievement in operations research and the management sciences. These individuals have demonstrated exceptional accomplishments and made significant contributions to the advancement of OR/MS over a period of time. Their service to the profession and to INFORMS has culminated in election to the INFORMS Fellow Award.

Class of 2012 newly-elected Fellows:

Guillermo Gallego	Ramayya Krishnan
Bezalel Gavish	Richard P. O'Neill
Daniel Granot	Rakesh Kumar Sarin
Patrick T. Harker	Yves Smeers
Michael N. Katehakis	Marius M. Solomon
Karl G. Kempf	Sridhar Tayur

Phoenix Area Workshop on O.R. for High School Math Teachers
Tuesday
Arizona State University, Mercado
8:00am-3:00pm
www.mindset.org
This workshop is based on a curriculum developed under NSF-funded Project MINDSET, (Mathematics Instruction using Decision Science and Engineering Tools). MINDSET uses decision making tools from industrial and systems engineering and operations research in a fourth-year high school mathematics curriculum. Principal performance related goals of the project are to improve upon the math students' ability to formulate and solve multi-step problems and interpret results, and to improve students' attitude toward mathematics.
Sponsored by Arizona State University-Fulton School of Engineering, National Science Foundation, INFORMS, Wayne State University, North Carolina State University, and University of North Carolina Charlotte.

Researchers, practitioners and students share their O.R. and analytics projects in these special sessions presented as poster displays, laptop demonstrations and other creative formats. Presenters benefit from the interactive critique, suggestions and encouragement from colleagues working in similar areas. Attendees benefit by being exposed to a broad range of topics, application areas, problems, methodologies and solutions – all in a condensed format and space.

This year, the Phoenix Organizing Committee has expanded and enhanced the Interactive program with additional focused-topic sessions. Three focused sessions are sponsored by the INFORMS Health Applications Society, INFORMS Transportation Science & Logistics Society and the INFORMS Section on Energy, Natural Resources and the Environment. Posters for these focused-topic areas are scheduled as integral parts of those subdivisions' tracks.

THANK YOU

PURDUE INDUSTRIAL ENGINEERING

sas

Abstracts and authors for posters are listed in the chronological program, under the day and time for each Interactive Session.

General Interactive Sessions
Monday, 12:30pm-2:30pm
Tuesday, 12:30pm-2:30pm
Convention Center – West 301CD Lobby
Cluster Chairs: Young Jun Son and Jian Liu, University of Arizona; Burcu Keskin, University of Alabama.

Energy, Natural Resources and the Environment Session
Sunday, 4:30pm-6:00pm
Center – North Building Foyer
Cluster Chairs: Lizhi Wang, Iowa State University and Yihsu Chen, University of California, Merced.

Transportation Science & Logistics Session
Monday, 4:30pm-6:00pm
Center – North Building Foyer
Cluster Chair: Elise Miller-Hooks, University of Maryland

Health Applications Interactive Session
Wednesday, 11:00am-12:30pm
Center – West 200 Foyer
Cluster Chair: Steven Shechter, Univ. of British Columbia

INTERACTIVE COMPETITION

INFORMS places special emphasis on high-quality poster presentations. All interactive session presenters, including those participating in the focused areas, were invited to submit their posters to the competition. In Round 1 of the process, submitters sent a PDF of their finished poster to the judging panel for review. The judges have evaluated these submissions and selected a group of semifinalists.

In Round 2, the judging panel will review the semifinalist presentations during the General Interactive Sessions in Phoenix. In Round 3—also held during the sessions in Phoenix – the judges will name the 1st, 2nd and 3rd place winners. There will be three winners identified and awarded each day. Recognition includes a plaque, an award check, and announcements in INFORMS newsletters and web site.

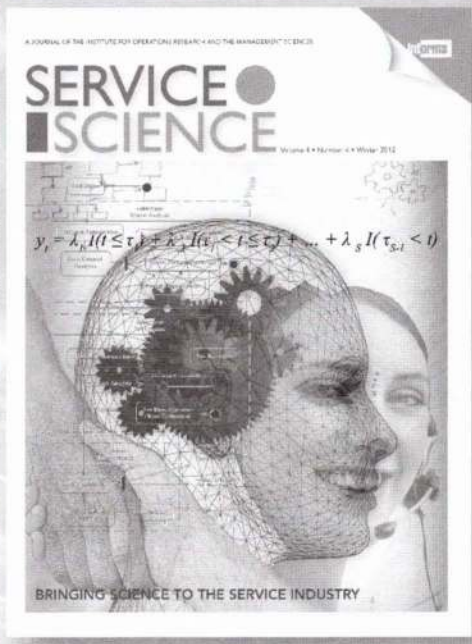
The judging panel is made up of distinguished ORMS professionals, both academics and practitioners, many of whom are INFORMS leaders. The Interactive Session program is co-chaired by Young Jun Son and Jian Liu, University of Arizona; and Burcu Keskin, University of Alabama.

Bringing Science to the Service Industry

Service Science

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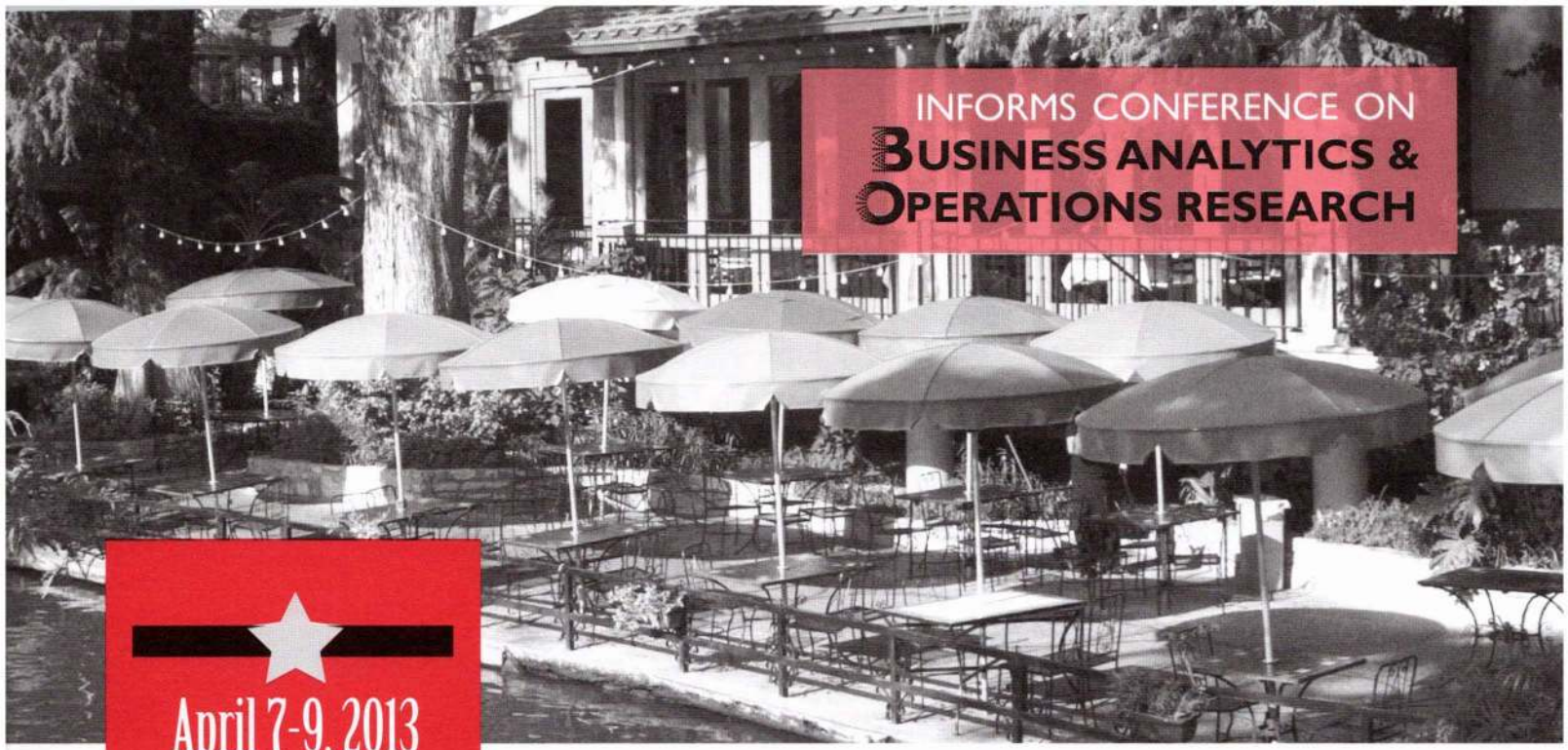


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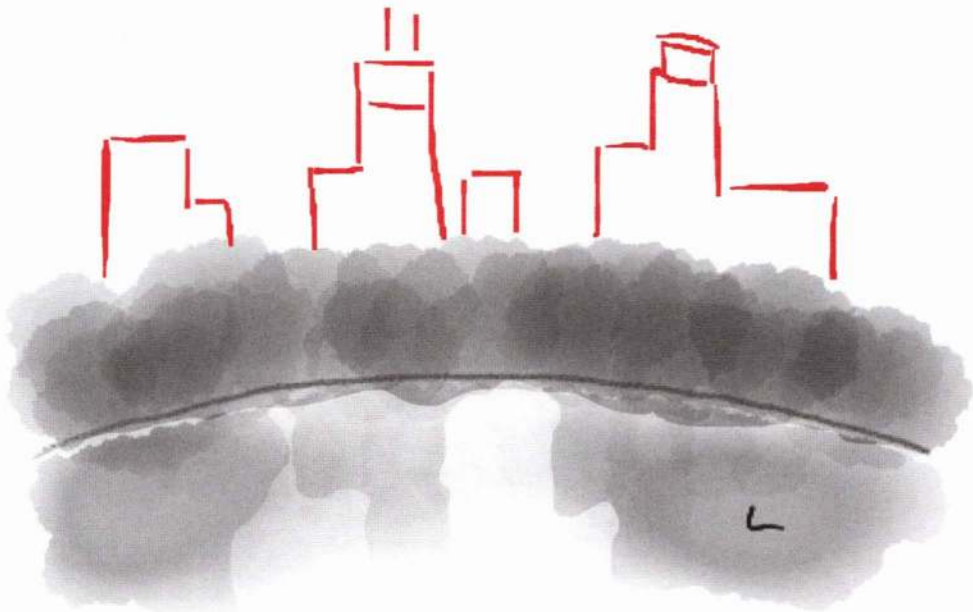
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Minneapolis 2013

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october 6-9, 2013

Minneapolis convention center

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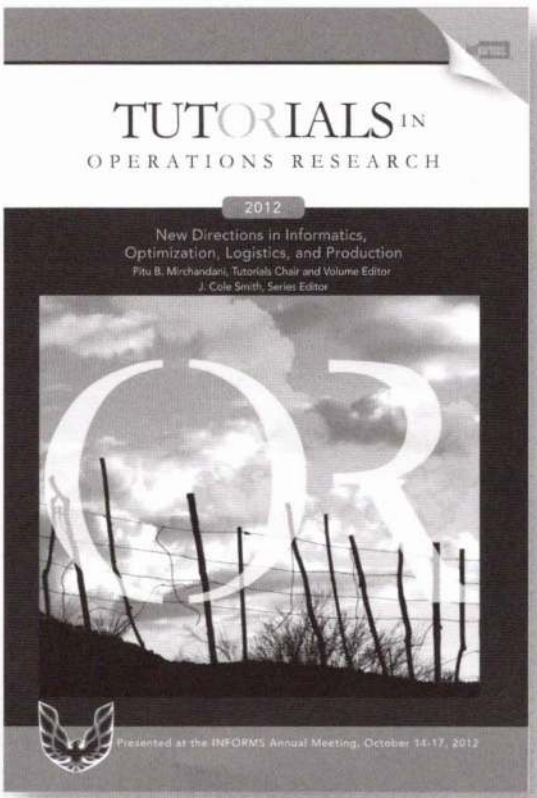
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FREE ACCESS!
2012 TutORials are now available ONLINE for all INFORMS Annual Meeting attendees!

TUTORIALS IN OPERATIONS RESEARCH

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New Directions in Informatics, Optimization, Logistics, and Production
Pitu B. Mirchandani, volume editor
J. Cole Smith, series editor



INFORMS 2012 edition of the *TutORials in Operations Research* series will be available online to all 2012 INFORMS Annual meeting registrants on October 1, 2012 as part of their meeting registration. All INFORMS 2013 members will be able to access all the 2012 TutORials content in its entirety starting January 1, 2013.

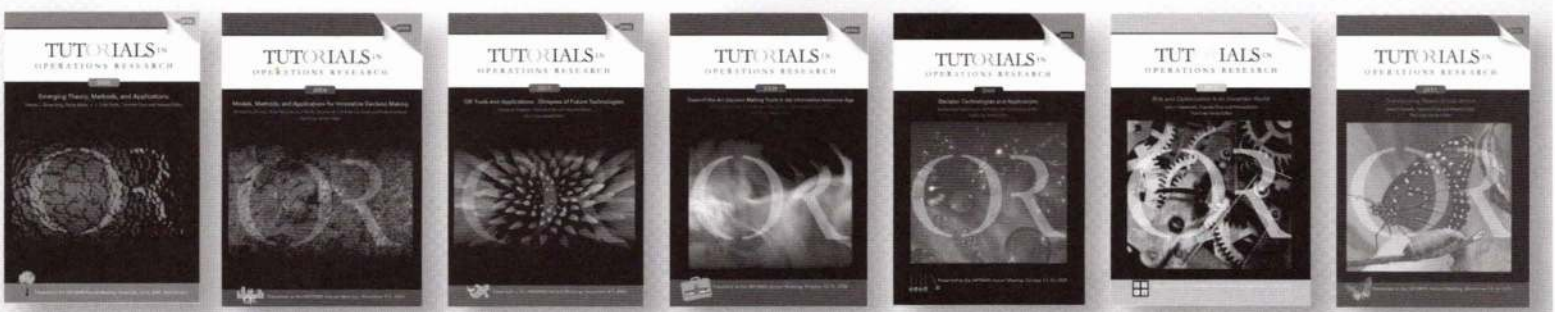
TutORials in Operations Research is a collection of tutorials published annually and designed for students, faculty, and practitioners. The series provides in-depth instruction on significant operations research specialties and practices. Use the searchable content for classrooms, boardrooms, and personal use on your desktop.

The 2012 *TutORials* volume covers a broad range of applications and methodologies within operations research. *New Directions in Informatics, Optimization, Logistics, and Production* contains 10 tutorial chapters focusing on recent developments and current issues facing operations researchers, professionals, and academics. This is a valuable reference and educational tool for today's O.R. professional.

SPECIAL OFFER:

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  - At least five years of analytics work-related experience for BA/BS holder
  - At least three years of analytics work-related experience for MA/MS holder
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DOMAINS OF ANALYTICS PRACTICE

Domain	Description	Weight*
I	Business Problem (Question) Framing	15%
II	Analytics Problem Framing	17%
III	Data	22%
IV	Methodology (Approach) Selection	15%
V	Model Building	16%
VI	Deployment	9%
VII	Life Cycle Management	6%
	*Percentage of questions in exam	100%

2013 CAP EXAM SCHEDULE



APRIL 7-9, 2013
INFORMS Conference on Business Analytics & O.R., San Antonio, TX



OCTOBER 6-9, 2013
INFORMS Annual Meeting, Minneapolis, MN

SUNDAY

WELCOME & PLENARY

10:00am-10:50am
Center, West 301A

Welcome

Terry Harrison, President, INFORMS
Professor of Supply Chain and Information Systems;
Earl P. Strong Executive Education Professor in Business
Pennsylvania State University

Ronald Askin, General Chair,
INFORMS Annual Meeting Phoenix
Professor of Industrial Engineering;
Director, School of Computing, Informatics, and
Decision Systems Engineering
Arizona State University

Plenary

OR Applications for Intelligence, Surveillance and Reconnaissance

Richard J. O'Lear
Defense Science Board
President and CEO, Sage Intelligence Associates

Several years ago, the Defense Science Board commissioned a task force on operations research (OR) applications for intelligence, surveillance and reconnaissance (ISR). The task force report noted: OR represents a powerful tool to help improve the quality of investment decision making by illuminating key issues, assumptions and sources of information. OR is applied inconsistently throughout the defense and ISR communities. OR and the use of it can be strengthened in the defense and ISR communities through effective institutionalization. The utility of OR can be more firmly established through appropriate test cases. This presentation will update the DSB report and emphasize the value of OR and its power as a tool to help prove the quality of ISR decisions. It will describe the inconsistency of OR use in making ISR decisions and the types of changes that could improve the efficiency and effectiveness of OR applications in the ISR decision making process. It also identifies some of the critical attributes for achieving success using OR tools to make ISR decisions.



Rich O'Lear returned to government service in 2011 as the Chief of the Intelligence Community (IC) Strategic Study Group, a small office that conducts studies for the Director of National Intelligence. In July 1993, he retired from the USAF as a Major General. During his 30-year career, he worked in, operated, managed and commanded U.S. foreign intelligence activities from field units to the national level. He earned a BS (Engineering) from the USAF Academy; an MA (History) from the University of Denver; an MA (Political Science) from Auburn University; and an MA (National Security Studies) from Georgetown University. After the U.S. Air Force, he worked for five years at Oracle Corporation and 11 years with Lockheed Martin where he was responsible for developing strategic and tactical business relationships with the IC, the DoD and major integrators in the intelligence, national security and information management areas. After Lockheed, he spent two years as president and CEO of SAGE, a consulting group that specialized in providing national security and intelligence-related advice. General O'Lear served on a number of advisory boards for the DoD and the IC, as well as the Defense Science Board and the AF Scientific Advisory Board. He is chairman emeritus of the AFCEA Intelligence Committee.

KEYNOTE

3:10pm-4:00pm
Center, West 101

Computational and Analytical Challenges and Opportunities in Personalized Medicine

George Poste
Chief Scientist, Complex Adaptive Systems Initiative;
Del E. Webb Chair in Health Innovation
Arizona State University

Rapid progress in systems biology and molecular analytical platforms offers the promise of major gains in the detection, treatment and prevention of diseases and for targeting therapeutic interventions to match the molecular and pharmacogenetic profiles of individual patients (personalized medicine). Whole genome sequencing and other molecular diagnostics, next-generation body imaging and miniaturized on-body/in-body sensors will assume increasing importance in the healthcare value chain as powerful platforms for precision diagnosis, selection of optimum treatment, treatment compliance and remote monitoring of individual health status.

Agility in forging new alliances between the hitherto separate sectors of (bio) pharmaceuticals, diagnostics, devices, computing, telecommunications and consumer social media networks will radically reshape the future healthcare landscape and the competitive environment. These accelerating trends will generate data on an unprecedented scale. Academia, industry, regulators and healthcare systems are ill-prepared for the technical, infrastructure, financial, organizational and cultural implications of "big data" and large scale computing initiatives in healthcare. Technical innovation has been, and will remain, fundamental to progress in healthcare. However, the acceleration of new discoveries and convergence of hitherto separate research disciplines and industrial sectors will generate complex economic, social and ethical questions regarding the "value" of innovation, how much new technology society can afford and how priorities for the allocation of expensive healthcare resources are set.



George Poste is Chief Scientist, Complex Adaptive Systems Initiative (CASI), Regents' Professor and Del E. Webb Chair in Health Innovation at Arizona State University. In 2003 he founded the Biodesign Institute at ASU and served as Director until 2009 during which time the Institute achieved cumulative research funding of $300 million. From 1992-1999 he was Chief Science and Technology Officer and President, R&D, of SmithKline Beecham (SB). At SB he was associated with the successful registration of 31 drug, vaccine and diagnostic products. In 2004 he was named as R&D Scientist of the Year by *R&D Magazine*; in 2006 he received the Einstein Award from the Global Business Leadership Council; and in 2009 received the Scrip Lifetime Achievement Award voted by the leadership of the global pharmaceutical industry. He has published over 350 research papers and edited 14 books on pharmaceutical technologies and oncology and has received honorary degrees in science, law and medicine for his research contributions. He was honored in 1999 by HM Queen Elizabeth II as a Commander of the British Empire for his contributions to international healthcare and security. Poste is a Fellow of the Royal Society, the Royal College of Pathologists and the UK Academy of Medicine, a Distinguished Fellow at the Hoover Institution, Stanford, and a member of the Council for Foreign Relations. He served as a member of the Defense Science Board from 2003 to 2009 and Health Board of the U.S. Department of Defense and is currently a member of the U.S. Institute of Medicine Board on Global Health.

KEYNOTE

Reprise of 2012 Edelman Award-Winning Presentation

3:10pm-4:00pm
Center, West 301A

Supply Chain-Wide Optimization at TNT Express

TNT Express: Marie-Christine Lombard, Chris Goossens, Marco Hendriks
Tilburg University: Hein Fleuren, Ineke Meuffels
ORTEC: John Poppelaars

TNT Express is one of the world's leading express delivery companies. The introduction of operations research (O.R.) at TNT Express during the past seven years has significantly improved decision-making quality and resulted in millions of Euros in cost savings. The Global Optimization Program (GO) initiative has led to the development of an entire suite of optimization solutions and the GO Academy, TNT's management development program for teaching the optimization principles. The tools and available knowledge allow operating units to analyze performance, identify optimization opportunities and overcome operational challenges. To date, the most significant savings originate from the network routing and scheduling solution (TRANS), the tactical route planning solution for pickups and deliveries (SHORTREC), and the supply chain solution (DELTA Supply Chain). As a result of all these initiatives, O.R. is now an effective part of TNT Express' DNA, and over the period 2008-2011, more than €207 million in savings were realized.

THE FRANZ EDELMAN AWARD
Achievement in Operations Research

The Franz Edelman Award for Achievement in Operations Research and the Management Sciences calls out, recognizes and rewards outstanding, high-impact applications of OR/MS. Each year, six to seven finalists compete in the "Super Bowl" of O.R. in practice. The 2012 finalists include Carlson Rezidor Hotel Group, Centers for Disease Control and Prevention, Danaos Corporation, Hewlett-Packard and Intel Corporation. In this keynote, the first-place TNT Express team will reprise their winning presentation.

MONDAY

PLENARY

Philip McCord Morse Lecture

10:00am-10:50am
Center, West 301A

Analytics for a Networked World

William R. Pulleyblank
Professor of Operations Research, Class of 1950 Chair of Advanced Technology, Dept. of Mathematical Sciences
United States Military Academy

The decade from 1947 to 1957 was a transformative time for applied mathematics. George Dantzig invented the simplex algorithm, Ralph Gomory developed his cutting plane algorithm for integer programming and a broad range of analytics applications emerged. Some came from military objectives, some from accelerating industrialization and some came from optimization of logistics. Philip McCord Morse was a key player in these activities. In addition to his many scientific contributions, in 1952 he was a member of the group that formed ORSA, one of the two societies that joined to become INFORMS. He also founded the Operations Research Center at MIT in 1956 and served as its director for its first twelve years.

Now, sixty years later, the world has changed significantly. The services sector is becoming the largest component of the economy in developed countries. Monolithic organizations are being replaced with dynamic networks of smaller units. Problems that used to require days or weeks on the largest computers available can now be solved in seconds on a smart phone. Massive amounts of data are being collected from a variety of sources and being transmitted and shared globally. The traditional strategy-tactics-operations cycle is being replaced with forms of continual optimization. The role of analytics in decision making is going from being a boutique activity to the mainstream. This presents a suite of new problems for applied mathematics, operations research and management sciences. I will discuss several of these as well as the possible consequences of their solutions. These will include applications in healthcare, business management and making real-time decisions in the face of uncertainty. I will also discuss what I believe are some of the most critical research issues going forward.



William (Bill) R. Pulleyblank received his PhD in Combinatorics and Optimization from the University of Waterloo in 1973. He spent 16 years in academia before joining IBM Research in 1990 as manager of the Optimization Center. From 1995-2000 he was Director of Mathematical Sciences in IBM Research. From 2001-2004, he led the Blue Gene project, which resulted in the production of the most powerful supercomputer in the world. Pulleyblank's last position at IBM was as Vice President of IBM's Center for Business Optimization within IBM's Global Business Services Organization. He linked the geniuses from IBM Research with IBM's clients to put mathematical algorithms to work solving critical business problems and tackling some of the toughest problems facing society. His group of consultants and mathematicians worked on seemingly unsolvable problems where the math is not understood or not solvable, where the data sets are massive or there is limited availability to data and where massive computing power may be needed. In a nutshell, they were tackling the most difficult problems in the world.

Bill Pulleyblank has held research chair positions, spoken at notable international forums and has been an editor for a number of mathematical, programming and combinatorial theory journals. He has also been a board member for mathematical and computational councils such as the U.S. National Research Council, iCORE Alberta, DIMACS External Advisory Board, the Division of Mathematical and Physical Sciences of the U.S. National Science Foundation, Fellow of the Fields Institute, and more. In 2010, he was elected to the National Academy of Engineering. Additionally, He has appeared in several movies, from the well known (Silver Streak with Richard Pryor, Gene Wilder, Jill Clayburgh), to the obscure (Golden Rod with Donald Pleasance), to the one nearest to his heart (the unreleased Wolf Boy, where he met his wife, Diane, to whom he has been married 32 years).

KEYNOTE

3:10pm-4:00pm
Center, West 101

The Future of High Performance Computing
Alan Gara, Intel Fellow and Director of Exascale Computing Pathfinding, Exascale Chief Architect
Intel Corporation

("Exascale" computing = a million trillion calculations per second. IBM's BlueGene/L has a peak performance of 596 teraflops. A petaflop is 1000 times faster than a teraflop, and an exaflop is 1000 times faster than a petaflop.)

The raw processing power of computing has increased more than 1000 fold over the last 15 years and has been driven primarily by the market supporting the needs of individual users. The functions that these computers perform today are similar to that of 15 years ago (spreadsheets, word processors and displaying of web pages). Lately, fast search, social media and now analytics will drive computing again aimed at providing better overall user experiences to the individual user. While market forces over the last 15 years have been driving computing resources to make better user experiences at the level of the individual, the engineering, scientific and business communities have been exploiting and sometimes helping to guide the direction of the advances. If we use recent history as our guide, we would predict that future computers to be used for engineering, science and business need to also have much in common with systems designed to be used for the improvement of usability and function for the individual user. Exascale computing systems will be examined from this perspective. There are a number of commodity mass markets to choose components from when considering Exascale and these will be discussed with respect to their ability to address the challenges of processor performance, network capability, system energy efficiency, system reliability and most importantly the overall
ability to extract results from an Exascale system. The question of whether we are now entering into a time when high performance computing can and must again sustain most of its ingredient components will therefore be addressed.



Alan Gara is an Intel Fellow and Director of Exascale Computing Pathfinding as well as Exascale Chief Architect at Intel Corporation. Prior to joining Intel he was an IBM Fellow and Chief Architect for the Blue Gene platform. The first IBM Blue Gene machine reached the #1 spot on the Top 500 list in November 2004, remaining at the #1 spot until November 2007. Since the Green 500 and the Graph 500 benchmarks were defined, Blue Gene machines have been #1 in both. IBM was awarded the National Medal of Technology and Innovation in 2008 from President Obama for the Blue Gene machine. Gara has received two Gordon Bell prizes (1998 and 2006) and the Seymour Cray award in 2010. He has over 70 publications in computer science and physics and more than 130 U.S. patents in the area of computer design and architecture. He received his PhD in Physics from the University of Wisconsin, Madison.

KEYNOTE

3:10pm-4:00pm
Center, West 301A

Manufacturing - Fading or Phoenix?
Wallace J. Hopp, Alessi Professor of Business Administration, Ross School of Business
University of Michigan

By most measures, manufacturing has been shrinking as a part of the U.S. economy for decades. Prevailing opinion among economists is that this represents a natural, even beneficial, progression toward a post-industrial economy. In contrast, politicians continue to be fond of factory photo ops and soaring rhetoric about the revitalization of American manufacturing. So what is the truth? How important is manufacturing to the economy of a developed country? How healthy is the U.S. manufacturing sector? Is a new era of manufacturing dawning? What factors will determine success in the manufacturing landscape of the future? To address these questions, we examine the economic data and argue that manufacturing in the U.S. is both more central to the economy and more cost competitive than commonly thought. But we also note that a wide swath of the manufacturing sector is at risk, largely due to non-economic factors. We discuss the implications of these findings for practice and policy, and highlight research questions where operations research scholars can play important roles in understanding and shaping the future of the manufacturing industry.



Wallace J. (Wally) Hopp has focused his teaching and research on the manufacturing field for over 25 years. In addition to publishing widely in OR and OM journals, he authored the books *Factory Physics* (with Mark Spearman), and *Supply Chain Science and Hospital Operations* (forthcoming with Bill Lovejoy). His awards include the 1990 Scaife Award (with Mark Spearman, for the paper with the "greatest potential for assisting an advance of manufacturing practice"), the 1998 IIE Joint Publishers Book-of-the-Year Award (for the book *Factory Physics*), the 2005 IIE Technical Innovation Award, and the 2006 SME Education Award. Hopp is a Fellow of INFORMS, MSOM, POMS, IIE and SME. He served as Editor-in-Chief of *Management Science* 2003-2008 and as President of the Production and Operations Management Society (POMS) 2009-2010. He has been an active industry consultant: clients have included Abbott Laboratories, Bell & Howell, Black & Decker, Boeing, Case, Dell, Ford, Eli Lilly, Eaton, Emerson Electric, General Electric, General Motors, John Deere, IBM, Intel, Motorola, Owens Corning, Schlumberger, S&C Electric, Texas Instruments, Whirlpool, Zenith, and others. He currently serves as Associate Dean for Faculty and Research at the Ross School of Business.

OMEGA RHO

OMEGA RHO, the official Honor Society of INFORMS, was founded in 1976 to recognize superior scholarship and encourage leadership in operations research, management science, and related disciplines. The society has 39 active collegiate chapters, more than 5,000 student and faculty members and is a member of the Association of College Honor Societies. In addition to sponsoring OMEGA RHO Distinguished Lectures at INFORMS Annual and International meetings, OMEGA RHO provides financial support to the annual INFORMS Colloquium. Honorary Membership in OMEGA RHO is bestowed upon individuals who provide leadership and extraordinary support for the encouragement of operations research and management science through their professional activities. Prior to delivering the OMEGA RHO Distinguished Lecture, Edward C. Prescott will be inducted as an Honorary Member of OMEGA RHO.

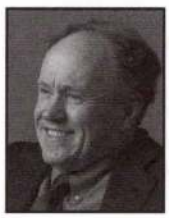
TUESDAY

PLENARY

Omega Rho Distinguished Lecture
10:00am-10:50am
Center, West 301A

Operations Research and the Revolution in Aggregate Economics
Edward C. Prescott
W.P. Carey Chaired Professor of Economics, Director of the Center for the Advanced Study in Economic Efficiency, Arizona State University
Senior Monetary Adviser, Federal Reserve Bank of Minneapolis

The extension of recursive methods to dynamic equilibrium modeling spawned a revolution in aggregate economics. This revolution has resulted in aggregate economics becoming, like physics, a hard science and not exercises in storytelling. Operations research played a major role in the development of practical methods to model dynamic aggregate economic phenomena and to predict the consequences of policy regimes. I learned about recursive methods when obtaining a Master's Degree in Operations Research at Case Institute of Technology in 1962-63. Of particular importance were the tools I mastered in a queuing course taught by Maurice Sasieni, though I learned some important lessons from Russell Ackoff in scientific methodology. The reason that these tools were important was that there were rational people in some of the models. This was in sharp contrast with the now defunct field of Keynesian macroeconomics, where economists searched for the dynamic system governing the evolution of the national income and product accounts statistics and other aggregate statistics. Robert E. Lucas tried to develop economic foundations for these empirically determined, policy-invariant, dynamic systems and found that the existence of such systems was inconsistent with dynamic economic theory. Subsequently recursive methods were used to develop a quantitative theory of aggregate fluctuations and other aggregate phenomena.



Edward C. Prescott is the W.P. Carey Chaired Professor of Economics and the Director of the Center for the Advanced Study in Economic Efficiency at Arizona State University. He is also a Senior Monetary Adviser at the Federal Reserve Bank of Minneapolis. In 2004, Prescott was awarded the Nobel Prize in Economic Sciences jointly with Finn Kydland for their contributions to dynamic macroeconomics, in particular, the time consistency of economic policy and the driving forces behind business cycles. In addition, he was awarded the 2002 Erwin Plein Nemmers Prize in Economics. Prescott has published more than 100 research articles, which address topics in money and banking, finance, business cycle theory, general equilibrium theory, and policy theory. In a 2000 book *Barriers to Riches*, Prescott and co-author Stephen Parente argued that barriers to technology adoption are the dominant cause of the large differences in standards of living across countries. In 2007, Prescott co-edited *Great Depressions of the 20th Century* with Timothy Kehoe. He received a BA in mathematics from Swarthmore College, an MS in operations research from Case-Western Reserve University, and a PhD in economics from Carnegie Mellon University.

KEYNOTE

3:10pm-4:00pm
Center, West 101

Principles to Successfully Navigate the Vortex of Innovation
Christopher B. Lofgren, President and CEO
Schneider National, Inc.

At the heart of innovation is change. Human beings and organizations are predisposed to resist change. Therefore, leadership and management play key roles in successfully delivering innovative solutions. This presentation highlights simple principles for guiding the creation and implementation of innovative solutions to challenging problems facing OR/MS practitioners. Examples will be given on how these principles were applied to, and shaped, solutions created and implemented by the Engineering Organization at Schneider National, Inc.



Christopher B. Lofgren is President and Chief Executive Officer at Schneider National Inc., a premier provider of transportation and logistics services. He joined Schneider Logistics in 1994 as vice president of engineering and systems. He later served as Chief Information Officer and Chief Operating Officer before being named President and Chief Executive Officer of Schneider National in 2002. Lofgren currently serves on the Board of Directors of CA Technologies, the Georgia Tech Advisory Board (GTAB), the Executive Committee and the Board of Directors of the American Trucking Associations, Inc. (ATA) and the Board of Directors of the American Transportation Research Institute, a research trust affiliated with the ATA. Locally, he is a member of the Senior Advisory Council for Junior Achievement of Brown County (Wisconsin) and previously served as a board member of the Green Bay Symphony Orchestra and the Green Bay, Wisconsin Boys & Girls Club. Before joining Schneider National Inc., Lofgren held positions at Symantec Corporation, Motorola and CAPS Logistics. He holds a bachelor's degree and a master's degree in industrial and management engineering from Montana State University and a doctorate in industrial and systems engineering from The Georgia Institute of Technology. In October 2009, Lofgren was inducted into the National Academy of Engineering.

KEYNOTE

IFORS Distinguished Lecture
3:10pm-4:00pm
Center, West 301A

Models and Algorithms for Passenger Railway Optimization Problems
Paolo Toth, Professor of Operational Research, Faculty of Engineering
University of Bologna

Passenger railway systems are highly complex systems requiring the solution of several planning problems that can be analyzed and solved through the application of mathematical models and optimization techniques, which generally lead to an improvement in the performance of the system, and also to a reduction in the time required for solving these problems. The planning process is generally divided into several phases. After a description of the whole planning process and of its main phases, the Platforming and Train-Unit Assignment phases are considered in more detail. In the Train Platforming Problem, we are given a set of timetabled trains, and the objective is to find the best assignment of the trains to the platforms (and to the routing paths connecting the arrival/departure tracks to the assigned platforms) in a railway station. An Integer Linear Programming (ILP) formulation is presented, and a column generation procedure is proposed for the solution of the corresponding continuous relaxation. An effective heuristic algorithm, driven by the continuous relaxation of the ILP formulation, is proposed as well. Computational results on real-world instances are reported. A train unit consists of a self-contained train with an engine and a set of wagons with passenger seats. The Train-Unit Assignment Problem calls for the definition of the "best" train units to be assigned to a given set of timetabled trips, each with a given number of passenger seats requested. Heuristic algorithms based on the solution of ILP models are presented. Computational results on real-world instances are reported.



Paolo Toth is Professor of Operational Research at the Faculty of Engineering of the University of Bologna. He is the author of more than 160 papers published in international journals and of the book *Knapsack Problems: Algorithms and Computer Implementations* (coauthor S. Martello; J. Wiley, Chichester, 1990). He is also Co-Editor of the books *Combinatorial Optimization* (J. Wiley, Chichester, 1979) and *The Vehicle Routing Problem* (SIAM Monographs on Discrete Mathematics and Applications, Philadelphia, 2002). He is currently a member of the Editorial Boards of the journals *Transportation Science, Networks, Journal of Heuristics, Journal of the Operational Research Society, European Journal of Operational Research* and many more. He was President of AIRO (Italian Operational Research Society) 1988-1995; President of EURO (Association of the European Operational Research Societies) 1995-1996; and President of IFORS (International Federation of the Operational Research Societies) 2001-2003. In May 1998, Toth delivered the Harold Larnder Memorial Lecture (annual Award of CORS). In 1998, he was conferred the EURO Gold Medal, the highest distinction within Operational Research in Europe. In May 2003, the University of Montreal conferred him a Doctorate honoris causa in Operational Research. In November 2005, the Transportation Science and Logistics Society of INFORMS conferred on him the Robert Herman Lifetime Achievement Award in Transportation Science.

KEYNOTE

Reprise of 2012 UPS George D. Smith Prize Award-Winning Presentation
3:10pm-4:00pm
Center, West 207

Excellence in Global Operations Education
Tauber Institute for Global Operations, University of Michigan: Lawrence M. Seiford, Goff Smith Co-Director; Diana Crossley, Managing Director

The Tauber Institute for Global Operations at the University of Michigan was awarded the first UPS George D. Smith Prize for effective and innovative preparation of students to be good practitioners of operations research. In this session they describe their unique and innovative program that provides interdisciplinary education, successfully uniting the fields of engineering and business. The program was designed from the start as collaboration between the University of Michigan's Stephen M. Ross School of Business and the College of Engineering with strong support from industry to provide students with superb educational experiences that are directly related to the current needs of industry. It provides a unique combination and level of training including a fourteen-week challenging, intensive real-world project experience as part of a mixed student team. The Tauber Institute strives to meet corporations' needs for a new kind of graduate – leaders with exceptional academic background and relevant professional experience who can successfully integrate business and engineering perspectives.

UPS GEORGE D. SMITH PRIZE

The UPS George D. Smith Prize, a new INFORMS award presented this year for the first time, recognizes an academic department or program for effective and innovative preparation of students to be good practitioners of O.R., management science or analytics.

WEDNESDAY

KEYNOTE

10:00am-10:50am
Center, West 301A

Risk and Decision Sciences to Inform Policy and Strategy at the U.S. Department of Homeland Security

Caryl Brzymialkiewicz, Executive Director for Risk and Decision Analysis
U.S. Department of Homeland Security

Caryl Brzymialkiewicz will address the creation of a multi-disciplinary federal analytic staff in DHS that anticipates critical Homeland Security challenges and offers valued decision support to DHS leadership by providing timely and relevant insight gained through rigorous, state-of-the-art qualitative and quantitative analysis. She will discuss the span and scope of current and future analytic work in the office of Strategy, Planning, Analysis and Risk (SPAR), including designing and refining core analytic processes, models and data that support DHS strategy, planning and analysis, and the execution of the Quadrennial Homeland Security Review (QHSR) requirements and missions. She will also comment on areas where SPAR is seeking information sharing and analytic community engagement to continue to advance the state of the art in Homeland Security strategic risk and decision analysis.



Caryl Brzymialkiewicz is the Executive Director for Risk and Decision Analysis, at the U.S. Department of Homeland Security (DHS), Office of Policy, Office of Strategy, Planning, Analysis & Risk (SPAR). Prior to joining DHS, she served as the Assessments Director and Division Chief, ORSA Division (J-9) at JIEDDO (Joint Improvised Explosive Device Defeat Organization), and as a Research Analyst at the Center for Naval Analyses. She holds a BE in Biomedical Engineering from Vanderbilt University, and a PhD in Biomedical Engineering from Duke University.

KEYNOTE

Award Presentation and Winner's Reprise
10:00am-10:50am
Center, West 101

2012 Daniel H. Wagner Prize Competition
Sponsored by CPMS, The Practice Section of INFORMS

The Daniel H. Wagner Prize is awarded for a paper and presentation that describe a real-world, successful application of operations research or advanced analytics. The prize criteria emphasize innovative, elegant mathematical modeling and clear exposition. Competitors for the 2012 prize include the United States Coast Guard (for scheduling patrols in the Port of Boston), the City of Philadelphia (for redesigning City Council districts that minimize gerrymandering), Duke Cancer Institute (for improving patient access), Mount Sinai Medical Center (for optimizing bed assignments), Rush University Medical Center (for improving cervical cancer treatment), and Supply Chain Management (accounting for lead time variability, particularly in multi-echelon networks).

The 2012 competition takes place on Monday in Track 23 (MA, MB, MC). The winner will then reprise their presentation in this keynote address.

The Daniel H. Wagner Prize emphasizes the quality and coherence of the analysis used in practice. Dr. Wagner strove for strong mathematics applied to practical problems, supported by clear and intelligible writing. This prize recognizes those principles by emphasizing high quality oral and written exposition, strong analytical content, and verifiable practice success.

SMDM-INFORMS JOINT PLENARY

5:00pm-5:50pm
Center, West 301A

Panel: What Pilots and the Airline Industry can Teach Clinicians and Hospitals about Patient Safety
Moderator: Mark S. Roberts, University of Pittsburgh

The airline industry has made tremendous advances in the safety of aviation over the past 30 years, and has successfully ingrained a culture of safety into operations. As reported by the Robert Wood Johnson Foundation, the formation of the Commercial Aviation Safety Team in the mid-1990s has reduced several types of airline fatalities to near zero. Unfortunately, after the landmark *To Err Is Human* report by the Institute of Medicine noted huge numbers of patients are harmed and die as a result of errors, no similar improvement has been witnessed in health care patient safety. This panel will explore how the successes of safety improvement in aviation can be translated into health care.

Arnold Barnett, PhD, is the George Eastman Professor of Management Science and a Professor of Statistics at the MIT Sloan School of Management. An INFORMS fellow, he is one of the world's leading experts on airline safety, who has contributed significantly to the development of the safety culture in the airline industry.

Brent James, MD, MStat, is the Chief Quality Officer, and Executive Director, Institute for Health Care Delivery Research at Intermountain Healthcare, in Salt Lake City, Utah. He has been an international leader in patient safety and quality improvement for nearly 30 years, and was a co-author on many of the IOM reports which have compared patient safety and airline safety.

Mark S. Roberts, MD, MPP, Professor and Chair of Health Policy and Management and the Graduate School of Public Health, University of Pittsburgh, a longstanding member of both INFORMS and SMDM, will moderate the session.

All sessions will be held in the Convention Center, West 207.

SUNDAY

■ SA16
8:00am-9:30am
Multiple Criteria Decision Making: Foundations and Some Approaches
Murat Köksalan, Middle East Technical University
Jyrki Wallenius, Aalto University School of Economics

In this tutorial we cover the foundations of Multiple Criteria Decision Making and define and demonstrate basic concepts. We classify approaches based on the problem structure as well as on the way decision maker's preferences are elicited. We discuss some approaches, emphasizing the interactive approaches. We demonstrate the concepts and approaches together with illustrative examples and graphs, and we provide information about further resources and references.

■ SB16
11:00am-12:30pm
Multi-Agent Scheduling Problems
Alessandro Agnetis, Università di Siena

In Multi-Agent Scheduling problems, a number of distinct agents, each owning a subset of all jobs, share common processing resources. The analysis in this case focuses on finding efficient and, possibly, fair solutions. After presenting some motivation, we review basic issues, illustrate the main complexity results, discuss related problems and point out future research needs.

■ SC16
1:30pm-3:00pm
Humanitarian Logistics
Ozlem Ergun, Pinar Keskinocak and Julie L. Swann, Georgia Institute of Technology

The increase in natural and man-made disasters in recent years has highlighted challenging problems in humanitarian operations, in addition to major long-term humanitarian development challenges. Humanitarian logistics plays an important role in preparing for, responding to, and recovering from sudden-onset disasters and addressing long-term development issues. The management of humanitarian logistics operations involves many challenges such as conflicting objectives from multiple stakeholders, coordination and collaboration, high uncertainty, and scarcity of resources. In this tutorial, we provide an introduction to humanitarian logistics and its main application areas while outlining current research trends and the major challenges faced in the area today. We also present four decision aid tools addressing typical applications of humanitarian logistics: network design for donated human breast milk delivery in South Africa, port simulation and shipment scheduling for a large international agency, demand estimation and emergency procurement for CARE, and post-disaster medical response under accessibility issues. In presenting these decision aid tools, we aim to underline the differences in issues arising from sudden-onset disasters and long-term development problems, various stages of the life cycle of disasters, and different decision levels, while also pointing to general aspects in modeling humanitarian logistics problems.

■ SD16
4:30pm-6:00pm
Application of Kalman Filter in Traffic Management and Control
Hans van Lint, Delft University of Technology

In many areas of traffic management and control the variables that are of most interest are often the ones that are most difficult to measure and estimate. Take for example vehicular density (veh/km) and space-mean speed (km/h). A reliable real-time estimate of these quantities is critically important for real-time control of traffic networks. However, neither can be straightforwardly deduced from available sensor data. Similarly elusive quantities are origin-destination flows. These depict the amount of vehicles per hour planning to go from one place to another at a certain moment. Unless we literally know the origin and destination of \textit{all} vehicles on a traffic network, advanced estimation techniques are required to extract OD patterns from whatever available data and prior knowledge we have available. One intuitive and highly effective method to solve these types of problems (i.e. estimating a quantity x when all we have are observations y and prior knowledge about the process) is the Kalman Filter, first proposed by Rudolf Kalman in 1960. In this TutORial we explain with many examples how this technique can be applied in the domain of traffic management and control to solve real-world problems. We'll see that Kalman filtering is a powerful technique that works surprisingly well in many cases, but there are also clear limitations that relate to the many assumptions underlying its application.

MONDAY

■ MA16
8:00am-9:30am
Some Simplifying Conditions for Markov Chain Modeling
Marlin Thomas, Air Force Institute of Technology

Under certain lumpability conditions the state space of a Markov chain can be partitioned into selected subsets of states to form a smaller chain that retains the Markov property, thus providing even greater simplicity in modeling operational systems. In this presentation we will discuss methods for construction lumped chains and their application. Examples will be provided for manpower planning and DNA testing applications.

■ MB16
11:00am-12:30pm
Clearing Functions, Variable Lead Times and Delay Equations in Production Planning
Dieter Armbruster, Arizona State University
Reha Uzsoy, North Carolina State University

We consider the problem of representing the capabilities of production systems to convert inputs into outputs over time in the face of deterministic demand. The fact that planning models generally operate in discrete-time while the factory being modeled operates in continuous time suggests the use of multimodel methods combining an optimization model that plans the releases into the plant over time with a simulation model that assesses the impacts of these releases on performance. We discuss several such schemes that have been implemented using discrete-event simulation, present recent computational results, and discuss their strengths and weaknesses. We then consider two alternative approaches that have emerged in the recent literature: the use of discrete-time linear programming models based on nonlinear clearing functions, and methods using systems of coupled partial differential equations based on transport phenomena. We identify the relationships between queueing models, clearing functions, and transport model-based methods, and discuss future research directions.

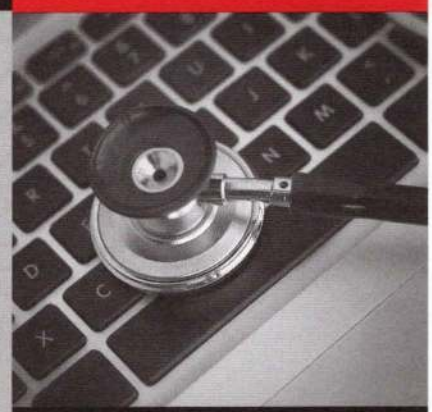
Continued on page 33

INFORMS HEALTHCARE 2013

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ON HEALTHCARE
June 23-26, 2013
Chicago, IL

Join us in Chicago for the second INFORMS conference on healthcare O.R. and analytics, offering:

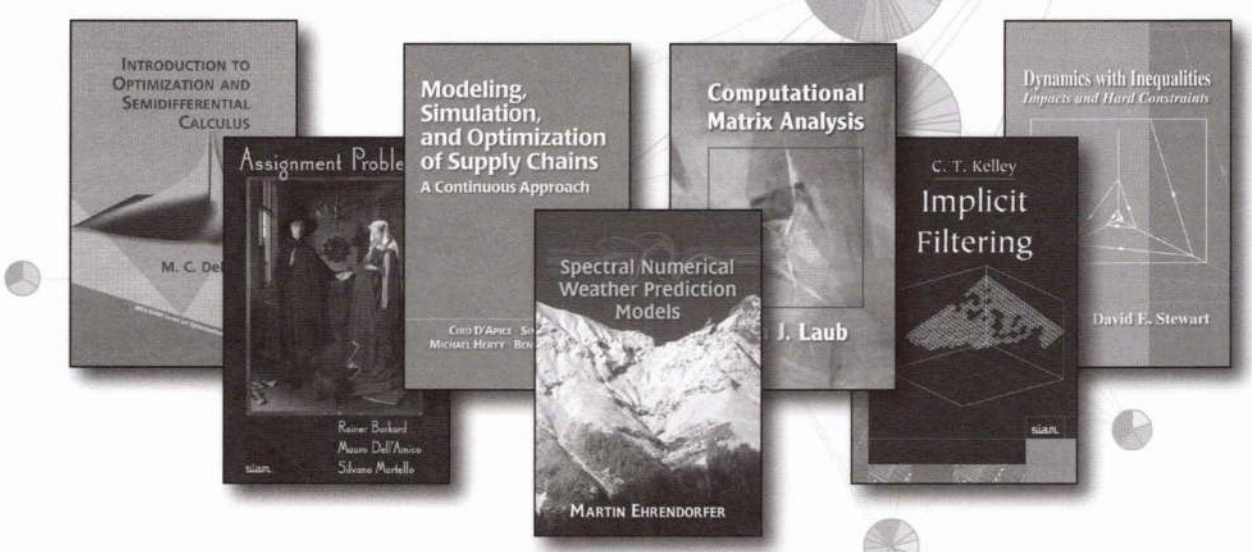
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10/12

All sessions will be held in the Convention Center, West 207.

Monday Continued

■ MC16
1:30pm-3:00pm
Regenerative Medicine Manufacturing – A Systems Engineering Perspective
Richard A. Wysk, Paul Cohen, Ola Harrysson, Molly Purser and Rohan Shirwaiker, North Carolina State University

This tutorial introduces the basic concepts associated with a regenerative medicine manufacturing (RMM) system. A background of regenerative medicine, the critical factors involved in its scale-up translation, and an overview of a systems engineering approach for RMM system design are presented.

■ MD16
4:30pm-6:00pm
Teaching Dynamic Programming and Duality Insights using Games, Interdiction, and Robust Optimization
J. Cole Smith, University of Florida

This tutorial discusses two aspects that often prove formidable to students: Dynamic programming (DP) and duality. We first discuss games that help teach DP concepts to undergraduate students in an entertaining and accessible manner. This background permits an application-oriented discussion of duality, which can in turn be used to teach emerging topics in interdiction and robust optimization. As a result, students may better understand the scope and limitations of modern optimization topics.

TUESDAY

■ TA16
8:00am-9:30am
Combinatorial Auctions
Subramanian Raghavan, University of Maryland

This tutorial provides an introduction to combinatorial auctions. Topics discussed will include bidding languages (how bidders can bid), solution methods (how do you decide who wins what), and pricing (how much do the winners pay). Some recent innovations in auction formats and pricing will be discussed including the Day-Raghavan procedure (also referred to as a core-selecting auction) which has been used in several government auctions to date. No familiarity with the area is assumed.

■ TB16
11:00am-12:30pm
Perishable Inventory Systems with Random Replenishments
David Perry, University of Haifa,
Wolfgang Stadje, University of Osnabrueck

A guide to perishable inventory systems (PIS's) that are refilled by randomly arriving items and not by ordering decisions is introduced. The literature on this class of PIS's (for which a blood bank or an organ transplantation center are prominent examples) is sparse. The survey starts with the pioneering work on a prototype model in which item arrivals and demand arrivals form independent Poisson processes. We show how to compute all performance measures of interest for this PIS. Thereafter, extensions in several directions are reviewed, among them (i) PIS's with finite capacity and waiting demands; (ii) PIS's with renewal item arrival times; (iii) batch arrivals of items or demands; (iv) actuarial valuation; (v) optimization and control. Some novel contributions are also introduced.

■ TC16
1:30pm-3:00pm
Mining Social Media: A Brief Introduction
Pritam Gundecha & Huan Liu, Arizona State University

The pervasive use of social media has generated unprecedented amounts of social data. Social media data is vast, noisy, unstructured, and dynamic in nature, thus novel challenges arise. This chapter reviews the basics of data mining and social media, introduces representative research problems, illustrates the application of data mining to social media using examples, and describes some projects of mining social media for "humanitarian assistance and disaster relief" for real-world applications.

■ TD16
4:30pm-6:00pm
Particle Filtering
John Birge, University of Chicago

Particle methods provide a robust methodology for estimation and prediction. They can also apply to traditional operations research areas by, for example, providing an effective alternative for constructing Monte Carlo simulations of various systems and for dynamic optimization. This tutorial explains the fundamental ideas behind particle methods and how to use them in typical operations research contexts.

WEDNESDAY

■ WA16
8:00am-9:30am
Introduction to the Data Mining Process
George Runger, Arizona State University

This tutorial introduces data mining with a focus on the data mining process. Descriptions of the objectives, steps, terminology, differences from traditional statistical analysis, and common applications are presented. The breadth of scope is illustrated. The process of model, estimate, validate is outlined with some illustrative methods.

■ WB16
11:00am-12:30pm
Maritime Shipping Logistics
Stefan Voss, Universität Hamburg Institut für Wirtschaftsinformatik

Maritime shipping has marked its undoubted importance in international freight transportation. Related service network design and infrastructure development especially regarding containerization has greatly advanced. This relies on efficient use of information technology and optimization. In this tutorial we classify the main logistics processes in maritime shipping and present a survey of related optimization methods.

Software Demonstrations

SUNDAY, OCTOBER 14

■ SA15

Center, West 202
8:00am–8:45am

Specifying "Logical" Conditions in AMPL Optimization Models

Robert Fourer, 4er@ampl.com

Optimization modelers are often stymied by the complications of converting problem logic into algebraic constraints suitable for solvers. The AMPL modeling language thus allows various logical conditions to be described directly. Additionally a new interface to the ILOG CP solver handles logic in a natural way not requiring conventional transformations.

8:45am–9:30am

Palisade Corporation - Avoiding Failure: Using @RISK to Identify, Analyze and Manage Risk More Successfully

Rafael Hartke, rhartke@palisade.com

Projects fail. They often fail for a lack of effective planning, either because of excess optimism in terms of time, cost and performance or because of extra work in the plan in terms of scope, resources and unforeseen events. @RISK employs Monte Carlo based simulation to give insight through sophisticated statistical analysis of the various potential outcomes. Understanding range outcomes facilitates effective risk management, prioritizing critical risks and managing expectations.

■ SB15

Center, West 202
11:00am–11:45am

Ziena Optimization LLC - New Developments in the KNITRO Optimization Solver

Richard Waltz, waltz@ziena.com

This software demonstration will highlight the latest developments and improvements in the KNITRO optimization solver. Benchmark results will be provided for various problem classes. The demo will also provide an overview of how to effectively use KNITRO in a variety of environments and interfaces.

11:45am–12:30pm

Artelys - Optimizing Military Attacks on Multi-Commodity Supply Chain Networks: a Min-Max Problem Solved with Artelys Kalis

Sylvain Mouret, sylvain.mouret@artelys.com

Learn how easy it is to solve general min-max problems arising in adversarial games with Artelys Kalis. Thanks to its hybrid CP/MIP architecture, it is possible to build an efficient branch and bound method specialized for such problems in just a few lines of code. We will demonstrate how Kalis has been embedded in a full-range operational solution based on the Artelys Network Designer GIS visualization platform. This solution is currently used to study supply chain network vulnerabilities with respect to military attacks.

■ SB20

Center, West 211B
11:00am–11:45am

American Optimal Decisions - Portfolio Safeguard (PSG): Advanced Nonlinear Mixed-Integer Optimization Package

Stan Uryasev, uryasev@aorda.com

Portfolio Safeguard is an advanced nonlinear mixed-integer optimization package used in risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (maximum, StDev, variance, probability, VaR, CVaR, cardinality, fixed-charge, recourse etc.). See real-life case studies in Windows and MATLAB at www.aorda.com/aod/psg.action.

■ SC15

Center, West 202
1:30pm–2:15pm

GAMS Development Corporation - Deploying Your Application Built Around GAMS

Michael Bussieck, mbussieck@gams.com
Lutz Westermann, lwestermann@gams.com

We will demonstrate the development of an application built around GAMS and its effortless deployment. Furthermore, we will show recent enhancements to the GAMS system.

2:15pm–3:00pm

Salford Systems - Real-World Data Analysis

Mikhail Golovnya, nancyb@salford-systems.com

This demo, intended for the modeler wanting to apply data mining methodology, will emphasize real-world data analysis. The main concepts behind well-known data mining algorithms will be discussed: CART®, MARS® automated non-linear regression, TreeNet® stochastic gradient boosting, RandomForests®, GPS™ Generalized Pathseeker, ISLE™ Importance Sampled Learning Ensembles and the Rulefit™ Rule Extraction Engine. We will discuss what is novel in the software, cover implementation, and show where the software fits in terms of other data mining software methods.

WIN AN iPAD2!

You can get into the running to win an iPad2 just by visiting the exhibits. INFORMS will award one iPad during each afternoon coffee break in the Exhibit Hall on Monday and Tuesday. Just follow these easy steps:

- Stop by one of the exhibit booths to pick up a raffle coupon (different color coupon for each day).
- Fill out the coupon and get it stamped by the exhibitor.
- While you're at the booth, give the exhibitor an opportunity to tell you about their company's products!
- Place your completed coupon in the raffle bin.
- Be present when the winning raffle ticket is drawn.
- You can submit as many coupons as you like, but each must be from a different exhibitor.

Schedule:

- Submit your coupon by 4:15pm in the Exhibit Hall.
- Drawing is at 4:15pm during the coffee break (4:00-4:30pm). Location in the Exhibit Hall will be announced–watch for signs in the Exhibit Hall.

NOTE: there is a different coupon for each day. Only coupons for that day will be eligible. You can submit as many coupons as you like, but each must be from a different exhibitor.

■ SC20
Center, West 211B
1:30pm–2:15pm
Spry, Inc. - The Analyst Workbench: Better Data, Faster Decisions
Todd Jones, tjones@spryinc.com

A single hub of integrated data, one that can be sliced however an analyst wants. The ability to quickly add and integrate new data sources; the ability to use R, Tableau and other familiar tools. These are the demands of today's analyst. This presentation will introduce the role semantic technologies and big data play in developing this data hub.

2:15pm–3:00pm
Oracle - Learn about Oracle Crystal Ball
Michael Franden, michael.franden@oracle.com

Oracle's Crystal Ball software is a spreadsheet-based software suite for predictive modeling, forecasting, Monte Carlo simulation and optimization. Crystal Ball is used in universities and schools worldwide to teach financial risk analysis, valuation, engineering, portfolio allocation, cost estimation, and project management. Join us for an overview of Crystal Ball and our teaching resources.

■ SD15
Center, West 202
4:30pm–5:15pm
Lumina Decision Systems, Inc. - Introduction to Analytica, What it Does that Spreadsheets Can't
Max Henrion, henrion@lumina.com

Experienced analysts prefer Analytica to spreadsheets because of its visual influence diagrams, Intelligent Arrays, fast Monte Carlo and scalability. Because it's designed by expert modelers, it's also an ideal tool for teaching students the art of effective modeling. View this software demo to see why users say that they can build, verify and analyze models in a quarter to half the time it takes with a spreadsheet.

5:15pm-6:00pm
Exploiting LINKS Simulations Web-Based Resources for Maximum Teaching and Learning Impact
Randall G. Chapman, chapman@LINKS-simulations.com

How can an instructor teach effectively and efficiently with a large-scale, team-based, competitive supply chain management simulation? By exploiting the simulation's web-based teaching and learning resources! This software demo explores web-based resources for supporting instructors and their students throughout LINKS simulation events.

MONDAY, OCTOBER 15

■ MA15
Center, West 202
8:00am–8:45am
Syncopation Software - DPL Even Easier from Excel!
Chris Dalton, cdalton@syncopation.com

The power of DPL comes to a cell near you! With DPL 8's new Excel add-in interface, key modeling and analysis features are right in front of you while you build your spreadsheet. Utilize decision trees, influence diagrams and Monte Carlo simulation in an intuitive environment. With DPL's unique, insightful outputs in Microsoft Office native formats, you can quickly analyze, format, tweak, copy and paste to create the ultimate PowerPoint presentation!

8:45am–9:30am
LINDO Systems, Inc. - Optimization Modeling Made Easy
Mark Wiley, mwiley@lindo.com
Gautier Laude, glaude@lindo.com

See the new LINDO API, LINGO and What'sBest! with enhancements to the linear, integer, stochastic, NLP and global solvers to exploit multicore hardware. Learn how easy it is to: (1) quickly build complex optimization models; (2) effortlessly access data in Excel and databases; and (3) seamlessly embed optimization into your own applications.

■ MB15
Center, West 202
11:00am-11:45am
Gurobi Optimizer for Client-Server Applications
Greg Glockner, glockner@gurobi.com

Client-server, multi-tier and cloud computing are popular methods in software engineering for high-volume or high-availability applications. We will discuss how this applies to optimization and see some optimization applications that can benefit from these architectures. Finally, we'll preview upcoming Gurobi features for client-server software applications.

11:45am-12:30pm
From Desktop to Network: Rolling Out AIMMS-Based Optimization Models
Peter Nieuwesteeg, p.nieuwesteeg@aimms.com
Deanne Zhang, d.zhang@aimms.com

AIMMS already makes it easy for you to build your optimization models and create a versatile user interface. With our just-released AIMMS PRO framework, you can now publish your AIMMS application in your own "App Store," allowing end-users to start the client application anywhere on the network, while the heavy lifting is done on the server. We will show how this client-server setup - combined with automated queuing - allows for efficient what-if analysis. Seeing is believing – come see for yourself!

■ MC15
Center, West 202
1:30pm–2:15pm
FICO - Introducing Xpress-Insight: Quick Visual Interaction with Optimization Models
Oliver Bastert, oliverbastert@fico.com

This demo will show you how to turn an optimization model into a full optimization application in minutes. Using the new FICO Xpress-Insight, you can start with an optimization model, create optimization scenarios, and compare and visually analyze the execution results. We'll explain how to customize Xpress-Insight and how to embed advanced custom user interfaces. In addition, we will give an overview of FICO's array of mathematical modeling and optimization tools, including FICO® Xpress Optimization Suite and FICO® Decision Optimizer.

2:15pm–3:00pm
Imagine That, Inc. - ExtendSim Simulation Software
Dave Krahl, davek@extendsim.com

Experience for yourself the ease of use, flexibility, and power of a professional simulation tool – ExtendSim. Use custom interactive model interfaces and hierarchical submodels to rapidly explore simulation concepts and design options. Realize why ExtendSim is the power tool of choice in the simulation industry. Don't miss this demo!

■ MD15
Center, West 202
4:30pm–5:15pm
Responsive Learning Technologies, Inc. - Online Games to Teach Operations and Supply Chain Management
Sam Wood, wood@responsive.net

Learn about online competitive exercises that are used in operations management courses and supply chain management courses to teach topics like capacity management, lead time management, inventory control, supply chain design and logistics. These games are typically used as graded assignments.

5:15pm–6:00pm
Clear and Simple High Performance Technical Computing with Julia
Michael Bean, mbean@forio.com

Julia is a new, high-performance dynamic programming language for technical computing that provides a sophisticated compiler, distributed parallel execution, numerical accuracy, and an extensive mathematical function library. Forio will demo its IDE for Julia that allows users to read, write, edit, and execute their Julia code and includes syntax-highlighting and code-completion.

Software Demonstrations

TUESDAY, OCTOBER 16

■ TA15

Center, West 202
8:00am–8:45am

AnyLogic Simulation Software - Examples and Customer Case Studies
George Gonzalez-Rivas, grivas@anylogic.com

Customer case studies and examples of AnyLogic. AnyLogic simulation software is compatible with Windows, MAC and Linux, allows you to build powerful simulation models and has 3D animation capabilities. AnyLogic works with three paradigms of modeling; system dynamics, agent based modeling and discrete event modeling.

8:45am–9:30am

JMP Software from SAS - Visual Analytics
Mia Stephens, mia.stephens@jmp.com

JMP Statistical Discovery Software is interactive and visual desktop software for Windows and Mac, with a complete array of integrated graphical and statistical procedures. We will demonstrate JMP tools for data analysis, visualization and exploration, including, Graph Builder®, bubble plots, the data filter, and our popular mapping tools.

■ TB15

Center, West 202
11:00am–11:45am

Frontline Systems, Inc. - Analytic Solver Platform: No-Compromise Analytics in Microsoft Excel
Daniel H. Fylstra, daniel@solver.com

Analytic Solver Platform, a deep integration of our Premium Solver, Risk Solver and XLMiner software, is a complete toolkit for predictive and prescriptive analytics – data mining, optimization and simulation. With a far lower learning curve than other analytics software, and unmatched performance on challenging large-scale models, it offers analysts "extreme productivity."

11:45am–12:30pm

Maximal Software - Deploying MPL Optimization Models on Tablet Computers and Mobile Platforms
Bjarni Kristjansson, bjarni@maximalsoftware.com

The IT industry is currently undergoing a major shift to new platforms such as tablet computers and mobile phones. We will demonstrate a new server-based version of MPL OptiMax that makes writing mobile applications a relatively quick and easy process. We will take you through all the steps of implementing optimization projects - finally deploying the project on a server for servicing both web and mobile clients, using standard programming languages, such as C/C++ or Python.

■ TC15

Center, West 202
1:30pm–2:15pm

Building and Solving Optimization Models with SAS
Ed Hughes, ed.hughes@sas.com
Rob Pratt, rob.pratt@sas.com

OPTMODEL from SAS provides a powerful, intuitive algebraic optimization modeling language and unified support for LP, MILP, QP and NLP models. We'll demonstrate OPTMODEL's clarity and flexibility in building and solving optimization models, including a review of its newest features. We'll also explore OPTMODEL's integration into a range of SAS data, analytic, and reporting capabilities.

2:15pm–3:00pm

SAS Global Academic Program - Introduction to SAS Rapid Predictive Modeler
Tom Bohannon, tom.bohannon@sas.com

This presentation is an introduction to SAS Rapid Predictive Modeler, a component of SAS Enterprise Miner. It provides an overview of the product and provides details on using SAS Rapid Predictive Modeler as part of the predictive modeling process and describes the difference between the basic, intermediate and advanced models that are available in SAS Rapid Predictive Modeler.

■ TD15

Center, West 202
4:30pm–5:15pm

IBM ILOG CPLEX Optimization Studio
Ferenc Katai, ferenc.katai@fr.ibm.com
Ed Klotz, klotz@us.ibm.com

Come learn how the latest integrated development environment enhancements combined with engine performance improvements and new features help mathematicians, OR experts, academicians, and business analysts leverage advanced analytics based on CPLEX optimization to make fact-based decisions in rapidly changing markets. A live demonstration of CPLEX Optimization Studio will be presented by experts from the largest staff of advanced analytics and optimization professionals of any company in the world.

5:15pm–6:00pm

Tableau Software - Stop Wrestling with Your Data- Start Exploring it with Tableau
Jonah Kim, jbkim@tableausoftware.com

Tableau Desktop is based on breakthrough technology from Stanford University that lets you drag and drop to analyze data. You can connect to data in a few clicks, then visualize and create interactive dashboards with a few more. Tableau Software transforms stubborn databases and spreadsheets into sources for easy investigations. It's so easy to use that any Excel user can learn it. Answer questions as fast as you can think of them.

WEDNESDAY, OCTOBER 17

■ WA15

Center, West 202
8:00am–8:45am

McGraw-Hill Higher Education - Practice Operations Multiplayer Simulation
Heather A. Kazakoff, heather_kazakoff@mcgraw-hill.com

Practice Operations is a multiplayer simulation of the clothing industry that enables students to practice operations and supply chain management in a competitive, real-world environment. Practice Operations is 3D and is designed for McGraw-Hill Education's line of digital learning products. Practice Operations supplements McGraw-Hill's Operations Management curriculum.

8:45am-9:30am

Provalis Research – QDA Miner and WordStat
Normand Peladeau, peladeau@provalisresearch.com

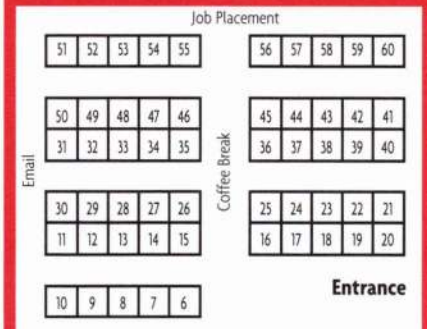
Analyzing open-ended responses, customer feedbacks, social media, or interview transcripts is often perceived as a time-consuming process. Provalis Research will present two software tools, QDA Miner and WordStat, which allow one to quickly analyze large collections of text, extract information, identify patterns, discover hidden relationships and relate structured and unstructured data.

EXHIBITS OPEN

Sunday, Oct. 14	12:00pm-5:00pm 7:30pm-9:00pm (Welcome Reception)
Monday, Oct. 15	9:00am-5:00pm
Tuesday, Oct. 16	9:00am-5:00pm
Wednesday, Oct. 17	9:00am-1:00pm

PHOENIX CONVENTION CENTER

West, Ballroom B-C-D



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Bellevue, WA 98004
www.aimms.com

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American Optimal Decisions #33
5214 SW 91st Way, Ste. 130
Gainesville, FL 32608
www.aorda.com

American Optimal Decisions (AOD) provides consulting services and software solutions in advanced statistics, optimization and risk management. The main software product is Portfolio Safeguard (PSG), an advanced non-linear mixed-integer optimization package. Use simple codes for sophisticated optimization problems, calling non-linear functions without additional programming. AOD provides consulting in various engineering areas involving statistics and optimization. See case studies at www.aorda.com/aod/psg.action.

AMPL Optimization, Inc. #26
900 Sierra Pl. SE
Albuquerque, NM 87108-3379
www.ampl.com

AMPL Optimization develops and supports the AMPL modeling language, a powerful and natural tool for creating and managing the large, complex optimization problems that arise in numerous applications. AMPL is notable for supporting a broad range of linear and nonlinear problem formulations and a large selection of popular large-scale solvers.

AnyLogic North America #12
53 Frontage Rd., Ste. 115
Hampton, NJ 08833
www.anylogic.com

AnyLogic simulation software will meet all your needs and is compatible with Windows, MAC and Linux. AnyLogic allows you to build powerful simulation models and has 3D animation capabilities. AnyLogic works with three paradigms of modeling: system dynamics, agent-based modeling and discrete event modeling.

Artelys #24
150 N. Michigan Ave., Ste. 800
Chicago, IL 60601
www.artelys.com

Artelys, an optimization and analytics company, is dedicated to providing sound decision-making through technology, O.R. and statistics. Artelys develops, distributes, and supports a comprehensive portfolio of efficient and robust tools, such as Artelys Kalis, FICO Xpress Optimization suite, and KNITRO. Artelys has been also successful in solving wide varieties of industrial problems using its optimization tools and development platform, Artelys Crystal.

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http://www.fico.com/en/Products/DMTools/Pages/default.aspx

FICO's optimization tools, Xpress Optimization Suite and Decision Optimizer, provide a connected suite of high-performance solvers to maximize resource efficiency and actions to improve profitability. As business decisions become increasingly important, FICO tools automate and improve operational decisions to enable companies to react faster, accelerate growth, control risk, and boost profits. Learn more at www.fico.com.

Forio Online Simulations **#27**
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San Francisco, CA 94107
www.forio.com

Julia is a new, high-performance dynamic programming language for technical computing that provides a sophisticated compiler, distributed parallel execution, numerical accuracy and an extensive mathematical function library. Forio provides an IDE for Julia that allows users to read, write, edit and execute their Julia code and includes syntax-highlighting and code-completion.

Frontline Systems, Inc. **#36**
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www.solver.com

See brand-new Analytic Solver Platform, our deeply integrated Excel-based software for data mining and predictive analytics, simulation and optimization, for beginning and power users, from Excel Solver developer Frontline Systems. Use our Solver SDK Platform and Web Service to deploy powerful cloud-based analytics applications. Take home a free trial CD.

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Washington, DC 20007
www.gams.com

The General Algebraic Modeling System (GAMS) is a high-level modeling system for mathematical programming and optimization. GAMS is tailored for complex, large-scale modeling applications, and allows you to build large maintainable models that can be adapted quickly to new situations. Come to our booth to learn more about our new GAMS distribution or ask for a trial version. We also invite you to visit our technology workshop or the software demo.

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San Jose, CA 95119
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The robust simulation architecture of ExtendSim contains advanced features that make it the most scalable simulation system available: create and couple an unlimited number of hierarchical subsystems; built-in database that facilitates organization of complex data structures to efficiently test multiple scenarios; full-featured authoring environment; evolutionary optimization; and advanced resource and scenario management. ExtendSim is the power tool of choice.

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www.lindo.com

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933 N. Kenmore St., Ste. 218
Arlington, VA 22201
www.maximalsoftware.com

Maximal Software is giving away a FREE development license of the MPL Modeling System to every meeting attendee! To sign up for your free copy, please visit us at our booth, attend our software demo (Tuesday, 11:45am), or attend our pre-conference workshop (Saturday, 12:00-2:30pm). We will also be introducing a new server-based version of MPL OptiMax, which makes writing optimization applications for tablet computers and mobile platforms, relatively quick and easy process.

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Oracle's Crystal Ball software is a spreadsheet-based software suite for predictive modeling, forecasting, Monte Carlo simulation and optimization. Crystal Ball is used in universities and schools worldwide to teach financial risk analysis, valuation, engineering, portfolio allocation, cost estimation and project management.

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Provalis Research is the world's leading developer of text analytics software with ground-breaking qualitative and quantitative analysis programs, such as QDA Miner, an innovative mixed-methods qualitative data analysis software; WordStat, a powerful add-on module for computer-assisted content analysis and text mining; and Simstat, an easy yet powerful statistical software.

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www.siam.org

Visit the SIAM booth to check out our new publications, including titles in the MOS-SIAM Series on Optimization and other recently published and best-selling SIAM books, all available at a conference discount. You'll also find sample issues of SIAM's renowned journals, including *SIOPT*, along with information and applications for anyone interested in becoming a SIAM member. And don't forget to pick up a copy of *SIAM News* for the road.

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Singapore
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Sulum Optimization **#54**
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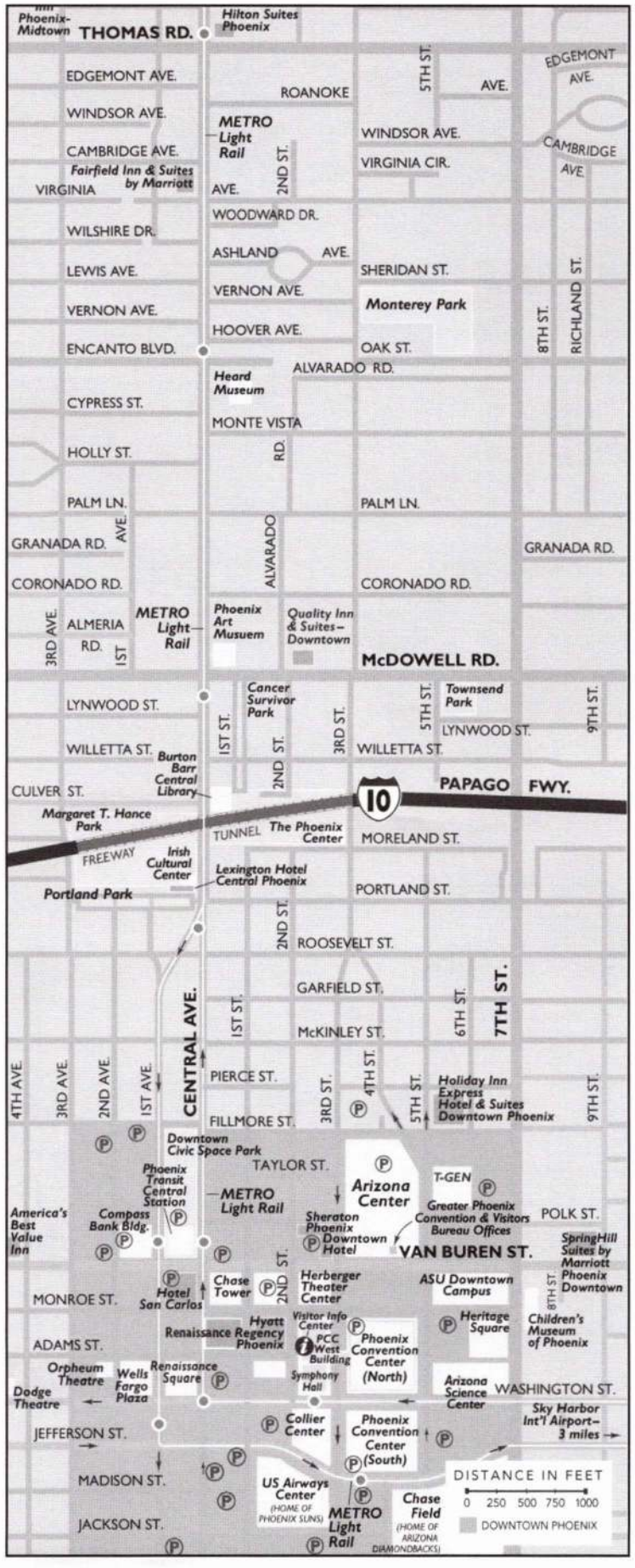
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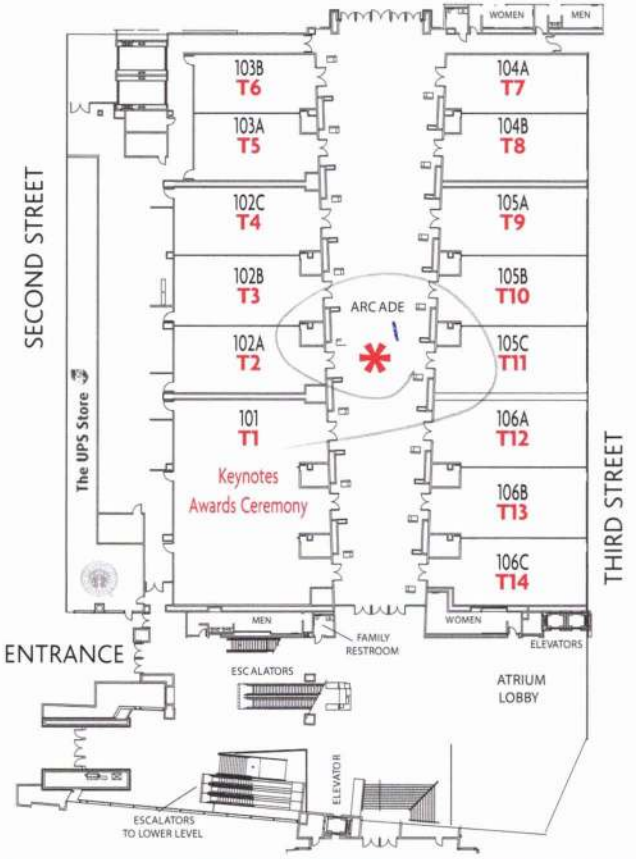
Ziena Optimization LLC **#23**
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Ziena was founded in 2001 by world-renowned scientists to provide robust software tools and responsive, professional technical support for difficult nonlinear optimization problems. Many Fortune 100 customers and hundreds of sites worldwide rely on Ziena's KNITRO solver to deliver optimization excellence in various financial, energy, communications, science and engineering applications.

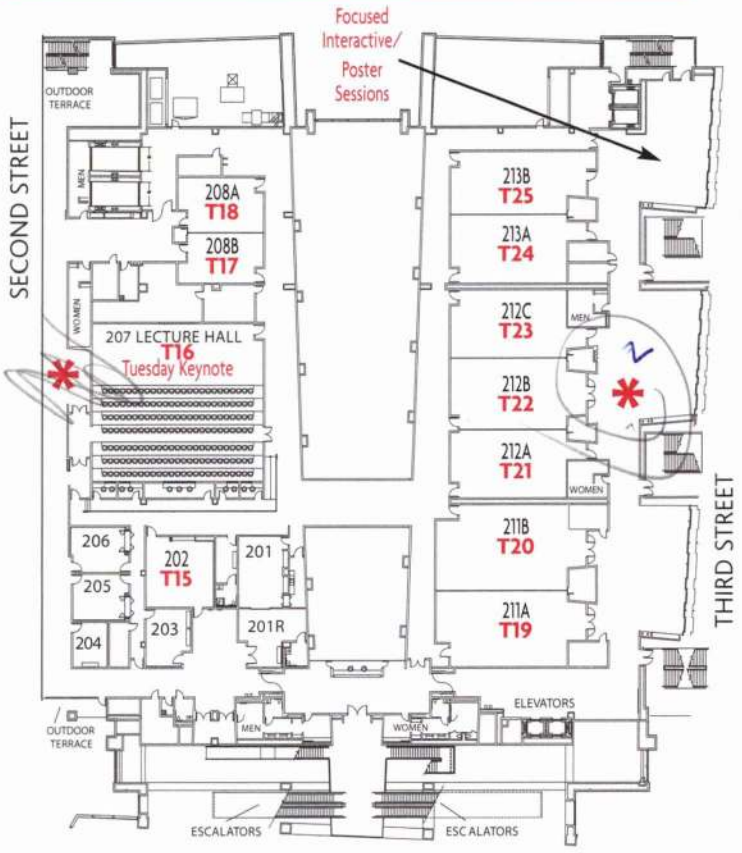

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ROANOKE
METRO Light Rail
2ND ST.
WOODWARD DR.
ASHLAND AVE.
VERNON AVE.
HOOVER AVE.
Heard Museum
MONTE VISTA RD.
ALVARADO
METRO Light Rail
Phoenix Art Museum
Quality Inn & Suites–Downtown
5TH ST.
VIRGINIA CIR.
SHERIDAN ST.
Monterey Park
OAK ST.
ALVARADO RD.
PALM LN.
CORONADO RD.
McDOWELL RD.
8TH ST.
RICHLAND ST.
EDGEMONT AVE.
CAMBRIDGE AVE.
GRANADA RD.
3RD AVE.
1ST AVE.
LYNWOOD ST.
WILLETTA ST.
CULVER ST.
Burton Barr Central Library
Cancer Survivor Park
1ST ST.
2ND ST.
3RD ST.
5TH ST.
Townsend Park
LYNWOOD ST.
WILLETTA ST.
9TH ST.
10
PAPAGO FWY.
Margaret T. Hance Park
TUNNEL
FREEWAY
The Phoenix Center
MORELAND ST.
Irish Cultural Center
Lexington Hotel Central Phoenix
Portland Park
PORTLAND ST.
2ND ST.
ROOSEVELT ST.
CENTRAL AVE.
1ST ST.
GARFIELD ST.
McKINLEY ST.
6TH ST.
7TH ST.
4TH AVE.
3RD AVE.
2ND AVE.
1ST AVE.
PIERCE ST.
3RD ST.
4TH ST.
5TH ST.
Holiday Inn Express Hotel & Suites Downtown Phoenix
9TH ST.
FILLMORE ST.
Downtown Civic Space Park
TAYLOR ST.
Phoenix Transit Central Station
METRO Light Rail
Arizona Center
T-GEN
Greater Phoenix Convention & Visitors Bureau Offices
POLK ST.
America's Best Value Inn
Compass Bank Bldg.
Sheraton Phoenix Downtown Hotel
VAN BUREN ST.
SpringHill Suites by Marriott Phoenix Downtown
Chase Tower
2ND ST.
Herberger Theater Center
ASU Downtown Campus
8TH ST.
MONROE ST.
Hotel San Carlos
Hyatt Regency Phoenix
Visitor Info Center
PCC West Building
Phoenix Convention Center (North)
Heritage Square
Children's Museum of Phoenix
ADAMS ST.
Renaissance Square
Symphony Hall
Orpheum Theatre
Wells Fargo Plaza
Dodge Theatre
Arizona Science Center
WASHINGTON ST.
Sky Harbor Int'l Airport–3 miles
JEFFERSON ST.
Collier Center
Phoenix Convention Center (South)
MADISON ST.
US Airways Center (HOME OF PHOENIX SUNS)
METRO Light Rail
Chase Field (HOME OF ARIZONA DIAMONDBACKS)
JACKSON ST.
DISTANCE IN FEET
0 250 500 750 1000
DOWNTOWN PHOENIX

Phoenix Convention Center

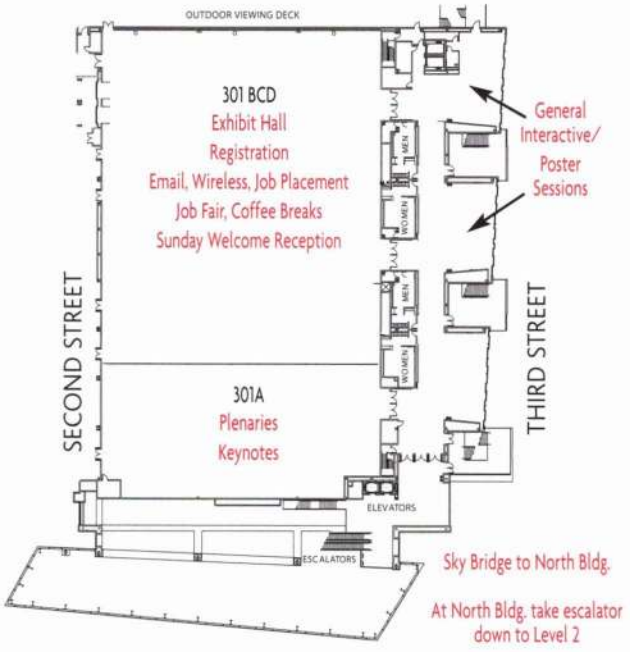
WEST 100 LEVEL - TRACKS 1-14



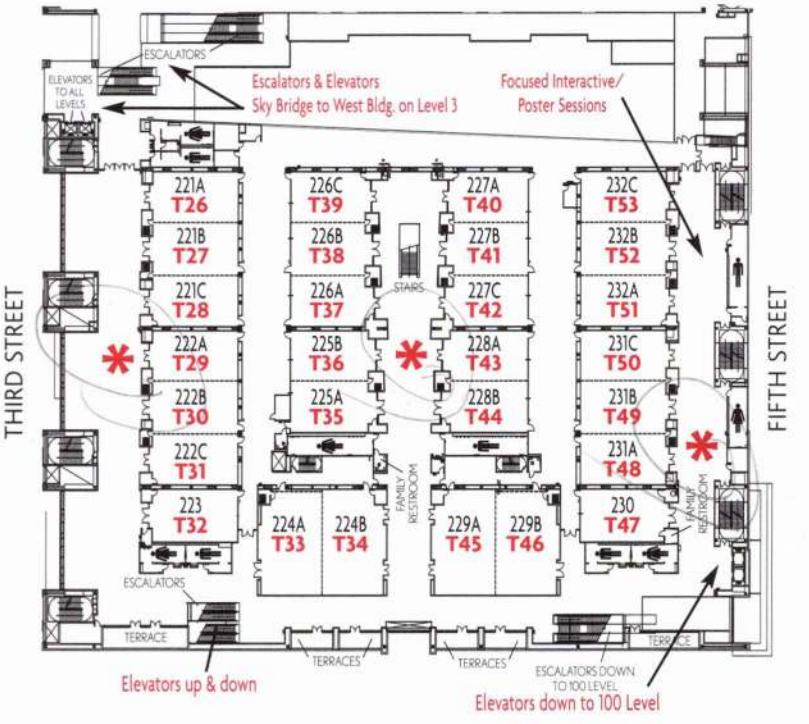
WEST 200 LEVEL - TRACKS 15-25



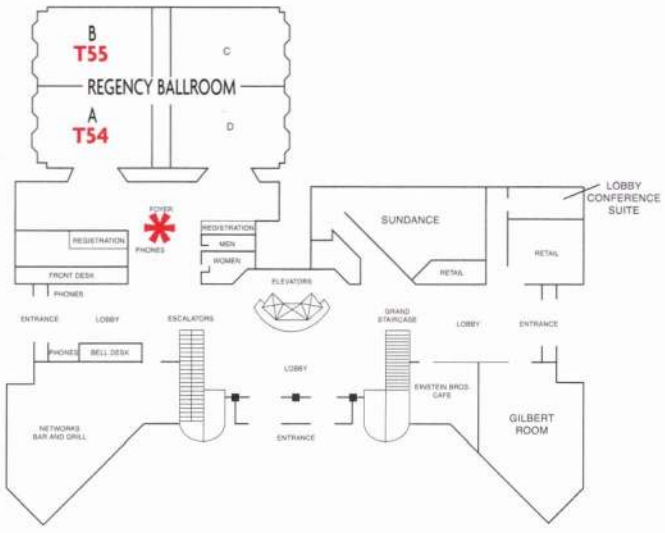
WEST 300 LEVEL



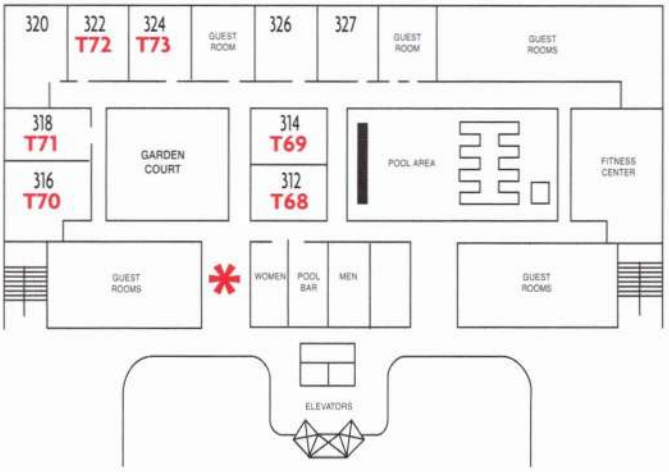
NORTH 200 LEVEL - TRACKS 26-53



HYATT FIRST FLOOR - TRACKS 54-55

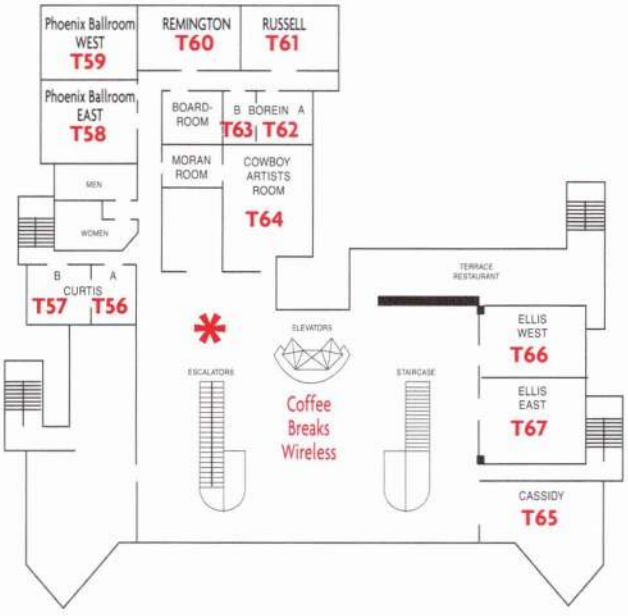


HYATT THIRD FLOOR - TRACKS 68-73



Coffee Breaks on Second Floor

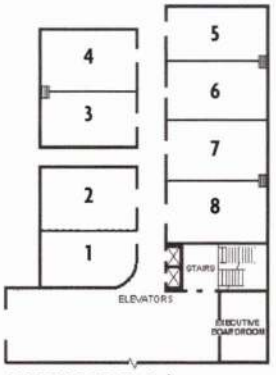
HYATT SECOND FLOOR - TRACKS 56-67



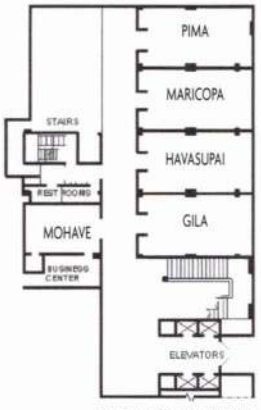
RENAISSANCE HOTEL - NO TRACKS



BALLROOM LEVEL



MEETING LEVEL-Salons



CONFERENCE LEVEL

LOBBY LEVEL
Goldwater Room

STREET LEVEL
Pueblo Room

Master Track Schedule – Sunday

C-Convention Center H-Hyatt R-Renaissance

Track	Room	SA 8:00-9:30	Plenary 10:00–10:50	SB 11:00-12:30	SC 1:30-3:00	Keynotes 3:10-4:00	SD 4:30-6:00
1	C- West 101	Metaheuristics		Metaheuristics	Opt.- Global Opt.		Opt.- Global Opt.
2	C- West 102 A	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
3	C- West 102 B	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
4	C- West 102 C	Decision Analysis	**Welcome & Plenary**	Decision Analysis	Decision Analysis	**Keynote**	Decision Analysis
5	C- West 103 A	Quality, Statistics & Reliability		QSR	QSR	**Edelman Reprise**	Process Engineering
6	C- West 103 B	Simulation		Simulation	Simulation	**2012 Winner**	Simulation
7	C- West 104 A	Data Mining	**Welcome:**	Data Mining	Data Mining	**TNT Express**	Data Mining
8	C- West 104 B	Public Programs	**Terry Harrison, President INFORMS**	Doing Good with Good OR Student Competition	Doing Good with Good OR Student Competition	**Supply Chain-Wide Opt. at TNT Express**	Public Programs
9	C- West 105 A	Multiple Criteria Decision Making		Multiple Criteria Decision Making	Multiple Criteria Decision Making		Multiple Criteria Decision Making
10	C- West 105 B	Opt.- Stochastic Programming	**Ronald Askin, Arizona State University**	Opt.- Stochastic Programming	Opt.-Stochastic Programming	**C - West 301A**	Opt.- Stochastic Programming
11	C- West 105 C	Stochastic Programming		Stochastic Programming	Stochastic Programming		Robust Opt.
12	C- West 106 A	Opt. - Integer Programming	**General Chair**	Opt. - Integer Programming	Opt. - Integer Programming		Opt. - Integer Programming
13	C- West 106 B	Opt.- Linear Prog.& Complementarity		Opt. - Linear Programming	Opt. - Linear Programming		Opt. - Linear Programming
14	C- West 106 C	Project Mgt.		Project Mgt.	Project Mgt.		Public Policy
15	C- West 202	AMPL & Palisade	**Plenary:**	Ziena & Aretlys	GAMS & Salford Systems	**Keynote**	Lumina Decision & LINKS Sim.
16	C- West 207	Tutorials	**Richard O'Lear**	Tutorials	Tutorials	**George Poste**	Tutorials
17	C- West 208 B	Opt.- Stochastic Programming	**OR Applications for Intelligence, Surveillance & Reconnaissance**	SpORts	SpORts	**Computational & Analytical Challenges & Opportunities in Personalized Medicine**	INFORM-ED
18	C- West 208 A	Network Opt.		Network Opt.	Network Opt.		Simulation
19	C- West 211 A	Healthcare Logistics		Healthcare Logistics	Healthcare Logistics		Healthcare Logistics
20	C- West 211 B	Public Programs		American Optimal Decisions	Spry & Oracle		Telecommunications
21	C- West 212 A	Networks & Graphs		Networks & Graphs	Opt.-Networks		Opt.-Networks
22	C- West 212 B	Computing Society	**C - West 301A**	Computing Society	Telecommunications		Computing Society
23	C- West 212 C	Telecommunications		CPMS	CPMS		CPMS
24	C- West 213 A	Health Applications Society		HAS	HAS	**C - West 101**	HAS
25	C- West 213 B	Health Applications Society		HAS	HAS		HAS
26	C- North 221 A	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
27	C- North 221 B	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
28	C- North 221 C	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
29	C- North 222 A	Workforce Mgt.		Workforce Mgt.	Workforce Mgt.		Workforce Mgt.
30	C- North 222 B	Mfg. & Service Operations Mgt. - iFORM		MSOM - iFORM	MSOM - iFORM		MSOM - iFORM
31	C- North 222 C	Managing Disruptions in SC		Managing Disruptions in SC	Managing Disruptions in SC		Managing Disruptions in SC
32	C- North 223	Manufacturing		Manufacturing	Mfg. & Service Operations Mgt.		Manufacturing
33	C- North 224 A	Mfg. & Service Ops Mgt.- -Sustainable Ops		MSOM - Sustainable Operations	MSOM - Sustainable Operations		MSOM - Sustainable Operations
34	C- North 224 B	Product Development		Product Development	Product Development		New Product Development
35	C- North 225 A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
36	C- North 225 B	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
37	C- North 226 A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Location Analysis		Location Analysis

Track	Room	SA 8:00-9:30	Plenary 10:00–10:50	SB 11:00-12:30	SC 1:30-3:00	Keynotes 3:10-4:00	SD 4:30-6:00
38	C- North 226 B	Service Science		Service Science	Service Science		Service Science
39	C- North 226 C	Service Science		Service Science	Service Science		Service Science
40	C- North 227 A	Energy, Natural Res. & Env.-Energy		ENRE - Energy	ENRE - Energy		ENRE-Environment & Sustainability
41	C- North 227 B	Energy		Energy	Energy		Energy
42	C- North 227 C	Freight Transportation		Freight Transportation	Transportation-Intelligent Systems		Transportation-Intelligent Systems
43	C- North 228 A	Railway Applications		Railway Applications	Railway Applications		Railway Applications
44	C- North 228 B	Supply Chain Mgt.		Supply Chain Mgt.	Supply Chain Mgt.		Supply Chain Mgt.
45	C- North 229 A	Junior Faculty Interest Group		Junior Faculty Interest Group	Minority Issues		Women in OR/MS
46	C- North 229 B	Organization Science		Organization Science	Organization Science		Organization Science
47	C- North 230	TSL-Intelligent Trans. Systems		TSL - ITS	TSL - ITS		TSL - ITS
48	C- North 231 A	Maritime Transportation		TSL- Freight Trans. & Logistics	TSL- Freight Trans. & Logistics		TSL- Freight Trans. & Logistics
49	C- North 231 B	Transportation Science & Logistics		TSL	TSL		TSL
50	C- North 231 C	Military Applications		Military Applications	Military Applications		Military Applications
51	C- North 232 A	Military Applications		Military Applications	Military Applications		Military Applications
52	C- North 232 B	Energy, Natural Res. & Env.-Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
53	C- North 232 C	Energy, Natural Res. & Env.-Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
Poster	C- North 200 -Foyer	No Session		No Session	No Session		ENRE - Poster Session
54	H- Regency A, Fl.1	Nicholson Student Paper Prize		Nicholson Student Paper Prize	2012 INFORMS Prize		INFORMS Journals Cluster
55	H- Regency B, Fl.1	O.R. in Emerging Economies		O.R. in Emerging Economies	O.R. in Emerging Economies		O.R. in Emerging Economies
56	H- Curtis A, Fl.2	Strategic Planning		Technology Mgt.	Technology Mgt.		Technology Mgt.
57	H- Curtis B, Fl.2	Bayesian Approach		Queueing	Queueing		Queueing
58	H- Phoenix East, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
59	H- Phoenix West, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
60	H- Remington, Fl.2	Revenue Mgt. & Pricing		Aviation Applications	Aviation Applications		Aviation Applications
61	H- Russell, Fl.2	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
62	H- Borein A, Fl.2	Auctions		Auctions	Auctions		Auctions
63	H- Borein B, Fl.2	Behavioral Operations		Behavioral Operations	Behavioral Operations		Behavioral Operations
64	H- Cowboy Artists, Fl.2	No Session		No Session	No Session		No Session
65	H- Cassidy, Fl.2	No Session		No Session	No Session		No Session
66	H- Ellis West, Fl.2	No Session		Data Mining	Data Mining		Data Mining
67	H- Ellis East, Fl.2	Quality, Statistics & Reliability		QSR	QSR		QSR
68	H- Suite 312, Fl.3	Finance		Finance	Finance		Financial Engineering
69	H- Suite 314, Fl.3	Finance		Opt. in Finance	Opt. in Finance		Opt. in Finance
70	H- Suite 316, Fl.3	Computational Social Science		Information Systems	Information Systems		Information Systems
71	H- Suite 318, Fl.3	eBusiness		eBusiness	eBusiness		eBusiness
→ 72	H- Suite 322, Fl.3	Cloud Computing		Cloud Computing	Cloud Computing		ICS-Advances in Opt. Modeling Languages & Systems
73	H- Suite 324, Fl.3	Economics		Quantitative Finance	Quantitative Finance		Quantitative Finance

Master Track Schedule – Monday

C-Convention Center H-Hyatt R-Renaissance

Interactive Session 12:30- 2:30, C - West Bldg. 300 Level

Track	Room	MA 8:00-9:30	Plenary 10:00–10:50	MB 11:00-12:30	MC 1:30-3:00	Keynotes 3:10-4:00	MD 4:30-6:00
1	C- West 101	Opt.- Global Opt.		Opt.- Global Opt.	Opt.- Global Opt.		Opt.- Global Opt.
2	C- West 102 A	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
3	C- West 102 B	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
4	C- West 102 C	Decision Analysis	**Plenary**	Decision Analysis	Multiple Criteria Decision Making	**Keynote**	Multiple Criteria Decision Making
5	C- West 103 A	Quality, Statistics & Reliability	**Philip McCord**	QSR	QSR	**Wallace J. Hopp**	QSR
6	C- West 103 B	Simulation	**Morse Lecture**	Simulation	Simulation	**Manufacturing-**	Simulation
7	C- West 104 A	Data Mining	**William R.**	Data Mining	Data Mining	**Fading or Phoenix?**	Data Mining
8	C- West 104 B	Public Programs	**Pulleyblank**	Public Programs	Public Programs		Public Programs
9	C- West 105 A	Multiple Criteria Decision Making	**Analytics for**	Multiple Criteria Decision Making	Multiple Criteria Decision Making	**C - West 301A**	Multiple Criteria Decision Making
10	C- West 105 B	Opt.- Stochastic Programming	**a Networked**	Opt.- Stochastic Programming	Opt.- Stochastic Programming		Opt.- Stochastic Programming
11	C- West 105 C	Robust Opt.	**World**	Opt.- Stochastic Programming	Opt.- Stochastic Programming		Opt.- Stochastic Programming
12	C- West 106 A	Opt. - Integer Programming		Opt. - Integer Programming	Opt. - Integer Programming		Opt. - Integer Programming
13	C- West 106 B	Opt. - Linear Programming	**C - West 301A**	Opt.- Linear Prog. & Complementarity	Opt.- Linear Prog. & Complementarity	**Keynote**	Opt.- Linear Prog. & Comp.
14	C- West 106 C	Scheduling & Project Mgt.		Scheduling & Project Mgt.	Scheduling & Project Mgt.	**Alan Gara**	Scheduling & Project Mgt.
15	C- West 202	Syncopation & LINDO Systems		Gurobi & AIMMS	FICO & Imagine That	**Future of High**	Responsive Learning & Forio
16	C- West 207	Tutorials		Tutorials	Tutorials	**Performance**	Tutorials
17	C- West 208 B	INFORM-ED		Analytics	INFORM-ED	**Computing**	INFORM-ED
18	C- West 208 A	Simulation		Simulation	Simulation		Opt.-ICS: Derivative-Free & Surr. Opt.
19	C- West 211 A	Healthcare Modeling		Health Care Simulation	Optimization	**C - West 101**	Healthcare Modeling & Opt.
20	C- West 211 B	George B. Dantzig Dissertation Prize		George B. Dantzig Dissertation Prize	Healthcare, Processes		Healthcare, Processes
21	C- West 212 A	Opt. - Networks		Opt. - Networks	Opt. - Networks		Opt.-Networks
22	C- West 212 B	Computing Society		Computing Society	Computing Society		Computing Society
23	C- West 212 C	Daniel H. Wagner Prize for Excellence in O.R.		Wagner Prize for Excellence in O.R.	Wagner Prize for Excellence in O.R.		Semiconductor Industry
24	C- West 213 A	Health Applications Society		HAS	HAS		HAS
25	C- West 213 B	Health Applications Society		HAS	HAS		HAS
26	C- North 221 A	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
27	C- North 221 B	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
28	C- North 221 C	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
29	C- North 222 A	Workforce Mgt.		Computing Society	MSOM- Healthcare Operations SIG		MSOM- Healthcare Ops. SIG
30	C- North 222 B	MSOM - iFORM		MSOM - iFORM	MSOM - iFORM		MSOM - iFORM
31	C- North 222 C	Managing Disruptions in SC		Managing Disruptions in SC	Managing Disruptions in SC		MSOM - Service Operations
32	C- North 223	Manufacturing		MSOM - Supply Chain	MSOM - Supply Chain		MSOM - Supply Chain
33	C- North 224 A	MSOM - Sustainable Operations		MSOM - Sustainable Operations	MSOM - Sustainable Operations		Inventory Mgt.
34	C- North 224 B	New Product Development		New Product Development	New Product Development		New Product Development
35	C- North 225 A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
36	C- North 225 B	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
37	C- North 226 A	Location Analysis		Location Analysis	Location Analysis		Location Analysis

Track	Room	MA 8:00-9:30	Plenary 10:00–10:50	MB 11:00-12:30	MC 1:30-3:00	Keynotes 3:10-4:00	MD 4:30-6:00
38	C- North 226 B	Service Science		Service Science	Service Science		Service Science
39	C- North 226 C	Service Industry		Service Industry	Service Industry		Retail Mgt.
40	C- North 227 A	ENRE - Environment & Sustainability		ENRE - Environment & Sustainability	ENRE - Environment & Sustainability		ENRE - Environment & Sustainability
41	C- North 227 B	Energy		ENRE - Environment & Sustainability	Energy		ENRE-Forestry
42	C- North 227 C	TSL-Urban Transportation		TSL-Urban Transportation	TSL-Urban Transportation		TSL-Urban Transportation
43	C- North 228 A	Railway Applications		Railway Applications	Railway Applications		Railway Applications
44	C- North 228 B	Supply Chain Mgt.		Green Supply Chain Mgt.	Supply Chain Opt.		Supply Chain, Competition
45	C- North 229 A	SpORts		Job Placement Services	Job Placement Services		Women in OR/MS
46	C- North 229 B	Organization Science		O.R. in Online Retail	Organization Science		Mfg. & Service Operations Mgt.
47	C- North 230	TSL - Intelligent Trans. Systems (ITS)		TSL - ITS	TSL - ITS		TSL - ITS
48	C- North 231 A	TSL- Freight Trans. & Logistics		TSL- Freight Trans. & Logistics	TSL- Freight Trans. & Logistics		TSL- Freight Trans. & Logistics
49	C- North 231 B	Trans. Science & Logistics		TSL	TSL		TSL
Poster	C- North 200 -Foyer	No Session		No Session	No Session		Trans Science & Log.- Poster Session
50	C- North 231 C	Military Applications		Military Applications	Military Applications		Military Applications
51	C- North 232 A	Military Applications		Military Applications	Military Applications		Military Applications
52	C- North 232 B	ENRE - Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
53	C- North 232 C	ENRE - Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
54	H- Regency A, Fl.1	Telecommunications		No Session	INFORMS Journals Cluster		INFORMS Journals Cluster
55	H- Regency B, Fl.1	O.R. in Emerging Economies		O.R. in Emerging Economies	O.R. in Emerging Economies		O.R. in Emerging Economies
56	H- Curtis A, Fl.2	Technology Mgt.		Technology Mgt.	Technology Mgt.		Technology Mgt.
57	H- Curtis B, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
58	H- Phoenix East, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
59	H- Phoenix West, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
60	H- Remington, Fl.2	Aviation Applications		Aviation Applications	No Session		Aviation Applications
61	H- Russell, Fl.2	Aviation Applications		Aviation Applications	Aviation Applications		App. in Emergency Mgt. & Terrorism Security
62	H- Borein A, Fl.2	Auctions		Auctions	Auctions		Auctions
63	H- Borein B, Fl.2	Behavioral Operations		Behavioral Operations	Behavioral Operations		Behavioral Operations
64	H- Cowboy Artists, Fl.2	No Session		No Session	No Session		No Session
65	H- Cassidy, Fl.2	No Session		No Session	No Session		No Session
66	H- Ellis West, Fl.2	Data Mining		Data Mining	Data Mining		Data Mining
67	H- Ellis East, Fl.2	QSR		QSR	QSR		QSR
68	H- Suite 312, Fl.3	Financial Services		Financial Services	Financial Services		Financial Services
69	H- Suite 314, Fl.3	Opt. in Finance		Opt. in Finance	Opt. in Finance		Opt. in Finance
70	H- Suite 316, Fl.3	Information Systems		Information Systems	Information Systems		Information Systems
71	H- Suite 318, Fl.3	eBusiness		eBusiness	eBusiness		eBusiness
72	H- Suite 322, Fl.3	ICS-Advances in Opt. Modeling Languages & Sys.		ICS-Advances in Opt. Modeling Languages & Sys.	Computational Stochastic Opt.		Computational Stochastic Opt.
73	H- Suite 324, Fl.3	Quantitative Finance		Quantitative Finance	Quantitative Finance		Quantitative Finance

Master Track Schedule – Tuesday

C-Convention Center H-Hyatt R-Renaissance

Interactive Session 12:30- 2:30, C - West Bldg. 300 Level

Track	Room	TA 8:00-9:30	Plenary 10:00–10:50	TB 11:00-12:30	TC 1:30-3:00	Keynotes 3:10-4:00	TD 4:30-6:00
1	C- West 101	Opt.- Global Opt.		Opt.- Global Opt.	Opt.- Global Opt.		Opt.- Global Opt.
2	C- West 102 A	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
3	C- West 102 B	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
4	C- West 102 C	Data Envelopment Analysis	**Plenary**	Data Envelopment Analysis	Data Envelopment Analysis	**Keynote**	Data Envelopment Analysis
5	C- West 103 A	QSR	**Omega Rho**	QSR	QSR	**IFORS Lecture**	QSR
6	C- West 103 B	Simulation & Opt.	**Edward C. Prescott**	Simulation	Simulation	**Paolo Toth**	Simulation
7	C- West 104 A	Data Mining	**O.R. & the**	Data Mining	Data Mining	**Passenger Railway**	Forecasting
8	C- West 104 B	Public Programs	**Revolution in**	Public Programs	Public Programs	**Opt. Problems**	Public Programs
9	C- West 105 A	Multiple Criteria Decision Making	**Aggregate**	Multiple Criteria Decision Making	Multiple Criteria Decision Making		Multiple Criteria Decision Making
10	C- West 105 B	Opt.- Stochastic Programming	**Economics**	Opt.- Stochastic Programming	Opt.- Stochastic Programming	**C - West 301A**	Opt.- Stochastic Programming
11	C- West 105 C	Opt.- Nonlinear Programming		Opt.- Nonlinear Programming	Opt.- Nonlinear Programming		Opt.- Nonlinear Programming
12	C- West 106 A	Opt. - Integer Programming	**C - West 301A**	Opt. - Integer Programming	Opt. - Integer Programming		Opt. - Integer Programming
13	C- West 106 B	Opt.-Linear Prog. & Complementarity		Opt.-Linear Prog. & Complementarity	Opt.-Linear Prog. & Complementarity		Opt. - Integer Programming
14	C- West 106 C	Scheduling & Project Mgt.		Scheduling & Project Mgt.	Scheduling & Project Mgt.	**Keynote**	Scheduling & Project Mgt.
15	C- West 202	AnyLogic & JMP		Frontline & Maximal	SAS & SAS Global Academic	**Christopher B.**	IBM ILOG & Tableau
16	C- West 207	Tutorials		Tutorials	Tutorials	**Lofgren**	Tutorials
17	C- West 208 B	INFORM-ED		INFORM-ED	INFORM-ED	**Principles to**	Operations Mgt.
18	C- West 208 A	Opt.-Computational Opt. & Software		Opt.-Computational Opt. & Software	Opt.-Computational Opt. & Software	**Successfully**	Opt.-Comp. Opt. & Software
19	C- West 211 A	Healthcare Modeling & Opt.		Healthcare Modeling & Opt.	Healthcare Modeling & Opt.	**Navigate the Vortex**	Healthcare Modeling & Opt.
20	C- West 211 B	Healthcare, Public Policy		Healthcare Strategy & Policy	Healthcare Strategy & Policy	**of Innovation**	Healthcare, Therapy & Treatment
21	C- West 212 A	Opt.-Networks		Opt.-Networks	Opt.-Networks		Opt.-Networks
22	C- West 212 B	Computing Society		Computing Society	Computing Society	**C-West 101**	Computing Society
23	C- West 212 C	Analytics		Analytics	Analytics		Analytics
24	C- West 213 A	Health Applications Society		HAS	HAS		HAS
25	C- West 213 B	Health Applications Society		HAS	HAS		HAS
26	C- North 221 A	Mfg. & Service Operations Mgt.		MSOM	MSOM	**Keynote**	MSOM
27	C- North 221 B	Mfg. & Service Operations Mgt.		MSOM	MSOM	**2012 UPS George**	MSOM
28	C- North 221 C	Mfg. & Service Operations Mgt.		MSOM	MSOM	**D. Smith Prize**	MSOM
29	C- North 222 A	MSOM- Healthcare Operations SIG		MSOM- Healthcare Operations SIG	MSOM- Healthcare Operations SIG	**University**	MSOM- Healthcare Operations SIG
30	C- North 222 B	MSOM-iFORM		MSOM-iFORM	Resource Allocation	**of Michigan,**	Facilities Planning
31	C- North 222 C	MSOM-Service Operations		MSOM-Service Operations	MSOM-Service Operations	**Tauber Institute for**	MSOM-Service Operations
32	C- North 223	MSOM-Supply Chain		MSOM-Supply Chain	MSOM-Supply Chain	**Global Operations**	MSOM-Supply Chain
33	C- North 224 A	Inventory Mgt.		Inventory Mgt.	Inventory Mgt.		Inventory Mgt.
34	C- North 224 B	New Product Development		New Product Development	New Product Development	**C - West 207**	New Product Development
35	C- North 225 A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
36	C- North 225 B	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
37	C- North 226 A	Location Analysis		Location Analysis	Location Analysis		Location Analysis

Track	Room	TA 8:00-9:30	Plenary 10:00–10:50	TB 11:00-12:30	TC 1:30-3:00	Keynotes 3:10-4:00	TD 4:30-6:00
38	C- North 226 B	Service Science		Service Science	Service Science		Service Science
39	C- North 226 C	Retail Mgt.		Topics in Operations Mgt.	Topics in Operations Mgt.		Topics in Operations Mgt.
40	C- North 227 A	ENRE-Environment & Sustainability		ENRE-Environment & Sustainability	ENRE-Environment & Sustainability		ENRE-Environment & Sustainability
41	C- North 227 B	ENRE-Forestry		ENRE-Forestry	ENRE-Forestry		ENRE-Forestry
42	C- North 227 C	TSL-Urban Transportation		TSL-Urban Transportation	TSL-Urban Transportation		Transportation Operations
43	C- North 228 A	Railway Applications		Railway Applications	Railway Applications		Railway Applications
44	C- North 228 B	Healthcare Supply Chain		Supply Chain Managing Disruptions	Supply Chain, Practice & Empirics		Supply Chain, Practice & Empirics
45	C- North 229 A	Junior Faculty Interest Group		JFIG	WORMS		JFIG
46	C- North 229 B	Disaster & Emergency Mgt.		Disaster & Emergency Mgt.	Game Theory		Game Theory
47	C- North 230	TSL- Intelligent Trans. Systems (ITS)		TSL- ITS	TSL- ITS		TSL- ITS
48	C- North 231 A	TSL-Freight Trans. & Logistics		TSL-Facility Logistics	TSL-Facility Logistics		TSL-Facility Logistics
49	C- North 231 B	Transportation Science & Logistics		Transportation Science & Logistics	Transportation Science & Logistics		Transportation Science & Logistics
50	C- North 231 C	Military Applications		Military Applications	Military Applications		Telecommunications
51	C- North 232 A	Military Applications		Military Applications	Military Applications		Military Applications
52	C- North 232 B	ENRE - Energy		ENRE - Energy	ENRE - Energy		ENRE/Env. & Sustainability
53	C- North 232 C	ENRE - Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
54	H- Regency A, Fl.1	KINFORMS (Korea Chapter-INFORMS)		No session	Applied Probability		ENRE - Mining
55	H- Regency B, Fl.1	No session		Undergraduate O.R. Prize	Undergraduate O.R. Prize		Health Applications
56	H- Curtis A, Fl.2	Technology Mgt.		Technology Mgt.	Technology Mgt.		Technology Mgt.
57	H- Curtis B, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
58	H- Phoenix East, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
59	H- Phoenix West, Fl.2	Applied Probability		Applied Probability	Applied Probability		Applied Probability
60	H- Remington, Fl.2	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
61	H- Russell, Fl.2	App. in Emergency Mgt. & Terrorism Security		App. in Emergency Mgt. & Terrorism Security	App. in Emergency Mgt. & Terrorism Security		App. in Emergency Mgt. & Terrorism Security
62	H- Borein A, Fl.2	Auctions		Auctions	Auctions		Auctions
63	H- Borein B, Fl.2	Behavioral Operations		Behavioral Operations	Behavioral Operations		Behavioral Operations
64	H- Cowboy Artists, Fl.2	No Session		No Session	No Session		No session
65	H- Cassidy, Fl.2	No Session		No Session	No Session		No session
66	H- Ellis West, Fl.2	Data Mining		Data Mining	Data Mining		Data Mining
67	H- Ellis East, Fl.2	QSR		QSR	QSR		QSR
68	H- Suite 312, Fl.3	Financial Services		Financial Services	Financial Services		Financial Services
69	H- Suite 314, Fl.3	Opt. in Finance		Opt. in Finance	Risk Analysis		Risk Analysis
70	H- Suite 316, Fl.3	Information Systems		Information Systems	Information Systems		Information Systems
71	H- Suite 318, Fl.3	eBusiness		eBusiness	eBusiness		eBusiness
72	H- Suite 322, Fl.3	Computational Stochastic Opt.		Computational Stochastic Opt.	Computational Stochastic Opt.		Computational Stochastic Opt.
73	H- Suite 324, Fl.3	Quantitative Finance		Production & Scheduling	Production & Scheduling		Production & Scheduling

Track	Room	WA 8:00-9:30	Keynotes 10:00–10:50	WB 11:00-12:30	WC 1:30-3:00	WD 3:20-4:50	Plenary 5:00-5:50
1	C- West 101	Opt.- Global Opt.		Opt.- Global Opt.	Opt.- Global Opt.	Opt.- Global Opt.	
2	C- West 102 A	Decision Analysis		Decision Analysis	No Session	Decision Analysis	
3	C- West 102 B	Decision Analysis		Decision Analysis	Decision Analysis	Decision Analysis	
4	C- West 102 C	Data Envelopment Analysis	**Keynote**	DEA	DEA	DEA	**INFORMS SMDM**
5	C- West 103 A	QSR	**Caryl**	QSR	QSR	QSR	**Joint Plenary**
6	C- West 103 B	Simulation	**Brzymialkiewicz**	Simulation	Simulation	No Session	**Mark Roberts**
7	C- West 104 A	Data Mining	**Policy & Strategy**	Data Mining	Data Mining	Data Mining	**Panel:**
8	C- West 104 B	Public Programs	**at U.S. Dept. of**	Public Programs	Public Programs	Public Programs	**What the**
9	C- West 105 A	Multiple Criteria Decision Making	**Homeland Security**	Multiple Criteria Decision Making	Multiple Criteria Decision Making	Multiple Criteria Decision Making	**Airline Industry**
10	C- West 105 B	Opt.- Stochastic Programming		No Session	Opt.- Stochastic Programming	Opt.- Stochastic Programming	**Can Teach About**
11	C- West 105 C	Opt.- Nonlinear Programming	**C - West 301A**	Opt.- Nonlinear Programming	Opt.- Nonlinear Programming	Nonlinear Program	**Patient Safety**
12	C- West 106 A	Opt. - Integer Programming		Opt. - Integer Programming	Opt. - Integer Programming	Opt. - Integer Programming	
13	C- West 106 B	Integer Programming		Integer Programming	Integer Programming	Integer Programming	**C - West 301A**
14	C- West 106 C	Scheduling & Project Mgt.		Scheduling & Project Mgt.	No Session	Vehicle Routing	
15	C- West 202	McGraw-Hill & Provalis		INFORMS Communities	No Session	No Session	
16	C- West 207	Tutorials	**Keynote**	Tutorials	No Session	No Session	
17	C- West 208 B	Revenue Mgt. & Pricing	**Daniel H. Wagner**	Education	Education	No Session	
18	C- West 208 A	Service Science	**Prize Winner**	Opt. Methodology	Opt. Methodology	Opt. Methodology	
19	C- West 211 A	Health Care, Therapy & Treatment	**C - West 101**	Health Care, Therapy & Treatment	INFORMS/SMDM Applications Joint Cluster	INFORMS/SMDM Applications Joint Cluster	
20	C- West 211 B	Health Care, Therapy & Treatment		Health Care, Therapy & Treatment	INFORMS/SMDM Applications Joint Cluster	INFORMS/SMDM Applications Joint Cluster	
21	C- West 212 A	Revenue Mgt. & Pricing		Opt.-Networks	Opt.-Networks	Opt.-Networks	
22	C- West 212 B	Learning		Computing Society	Computing Society	Computing Society	
23	C- West 212 C	No Sesison		Spreadsheet Productivity Research	Health Care	No Session	
24	C- West 213 A	Health Informatics		Health Informatics	No Session	Health Informatics	
25	C- West 213 B	Health Applications Society		HAS	HAS	HAS	
Poster	C- West 200 Foyer	No Session		Health Applications Society-Poster	No Session	No Session	
26	C- North 221 A	Mfg. & Service Oper Mgt.		MSOM	MSOM	No Session	
27	C- North 221 B	No Session		MSOM	MSOM	MSOM	
28	C- North 221 C	Mfg. & Service Oper Mgt.		MSOM	MSOM	MSOM	
29	C- North 222 A	MSOM-Healthcare Operations SIG		MSOM-Healthcare Operations SIG	MSOM-Healthcare Operations SIG	MSOM-Healthcare Operations SIG	
30	C- North 222 B	Facility Location		Facility Location	Facility Location	Facility Location	
31	C- North 222 C	MSOM - Service Operations		MSOM - Service Operations	MSOM - Service Operations	MSOM - Service Operations	
32	C- North 223	MSOM - Supply Chain		MSOM - Supply Chain	MSOM - Supply Chain	MSOM - Supply Chain	
33	C- North 224 A	Inventory Mgt.		Inventory Mgt.	Marketing	Marketing	
34	C- North 224 B	Logistics		Logistics	Logistics	ReMfg.	
35	C- North 225 A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing	
36	C- North 225 B	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	No Session	No Session	

Track	Room	WA 8:00-9:30	Plenary 10:00–10:50	WB 11:00-12:30	WC 1:30-3:00	WD 3:20-4:50	Plenary 5:00-5:50
37	C- North 226 A	Location Analysis		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing	Revenue Mgt.	
38	C- North 226 B	Service Science		Service Science	Service Science	Service Science	
39	C- North 226 C	Operations Mgt.		Operations Mgt.	Marketing	Combinatorial Opt.	
40	C- North 227 A	ENRE - Environment & Sustainability		Energy	Grids	Smart Grids	
41	C- North 227 B	ENRE- Mining		ENRE- Mining	ENRE- Mining	ENRE- Mining	
42	C- North 227 C	Transportation		Transportation Planning	Transportation Planning	Energy	
43	C- North 228 A	Railway Applications		Transportation	Transportation	Rail Transportation	
44	C- North 228 B	Risk Mgt.		Risk Mgt.	Risk Mgt.	Risk Mgt.	
45	C- North 229 A	Minority Issues		Minority Issues	Minority Issues	Organization Theory	
46	C- North 229 B	Game Theory		Sustainability	Sustainability	TSL - ITS	
47	C- North 230	TSL - Intelligent Trans. Systems (ITS)		TSL - ITS	No Session	TSL - ITS	
48	C- North 231 A	Trans. Science & Logistics - Facility Log.		TSL- Facility Logistics	TSL- Facility Logistics	TSL- Facility Logistics	
49	C- North 231 B	Transportation Science & Logistics		Transportation Science & Logistics	TSL- Urban Transportation	TSL- Urban Transportation	
50	C- North 231 C	No Session		No Session	No Session	No Session	
51	C- North 232 A	Military Applications		Military Applications	Military Applications	Military Applications	
52	C- North 232 B	ENRE - Energy		ENRE - Energy	ENRE - Energy	ENRE - Energy	
53	C- North 232 C	ENRE - Energy		ENRE - Energy	ENRE - Energy	ENRE - Energy	
54	H- Regency A, Fl.1	Disease Mgt.		QSR	No Session	No Session	
55	H- Regency B, Fl.1	Aviation Applications		Vehicle Routing	Product Developemnt	No Session	
56	H- Curtis A, Fl.2	Technology Mgt.		Technology Mgt.	Technology Mgt.	Natural Resources	
57	H- Curtis B, Fl.2	Applied Probability		Applied Probability	Decision Support	Decision Support	
58	H- Phoenix East, Fl.2	Applied Probability		Applied Probability	Applied Probability	No Session	
59	H- Phoenix West, Fl.2	No Session		Applied Probability	Applied Probability	No Session	
60	H- Remington, Fl.2	Aviation Applications		Applied Probability	Aviation Applications	Aviation Applications	
61	H- Russell, Fl.2	App. in Emergency Mgt. & Terrorism Security		App. in Emergency Mgt. & Terrorism Security	App. in Emergency Mgt. & Terrorism Security	Homeland Security	
62	H- Borein A, Fl.2	Managing Product Variety		Outsourcing	Reliability	No Session	
63	H- Borein B, Fl.2	Behavioral Operations		Supply Chain	No Session	Flow Shop	
64	H- Cowboy Artists, Fl.2	Data Mining		Reliability	Reliability	Reliability	
65	H- Cassisy, Fl.2	Data Mining		Data Mining	Data Mining	Data Mining	
66	H- Ellis West, Fl.2	Data Mining		Data Mining	QSR	QSR	
67	H- Ellis East, Fl.2	QSR		QSR	QSR	QSR	
68	H- Suite 312, Fl.3	Financial Services		Financial Services	Financial Services	Financial Services	
69	H- Suite 314, Fl.3	Risk Mgt.		Risk Mgt.	Risk Mgt.	Risk Mgt.	
70	H- Suite 316, Fl.3	Information Systems		Information Systems	Information Systems	Information Systems	
71	H- Suite 318, Fl.3	E-Business & E-Commerce		E-Commerce	Information Systems	Information Systems	
72	H- Suite 322, Fl.3	Vehicle Routing		Computational Stochastic Opt.	Vehicle Routing	Vehicle Routing	
73	H- Suite 324, Fl.3	Scheduling		Scheduling	Scheduling	Scheduling	

Invited Cluster Chairs

Amazon
Stephen Graves
Massachusetts Institute of Technology

Applications in Emergency Management & Terrorism Security
Henry Willis
Rand Corporation

Auctions
Robert Day
University of Connecticut

Cloud Computing
Ilyas Iyoob
Gravitant

Guoliang Xue
Arizona State University

Computational Social Sciences
Amin Saberi
Stanford University

Daniel H. Wagner Prize for Excellence in O.R.
Allen Butler
Daniel H. Wagner Associates, Inc.

Data Envelopment Analysis
Andrew L. Johnson
Texas A & M University

Doing Good with Good O.R. Student Competition
Sila Cetinkaya
Texas A&M University

Susan E. Martonosi
Harvey Mudd College

George B. Dantzig Dissertation Prize
Aliza R. Heching
IBM T.J. Watson Research Center

Health Informatics
William Pavlicek
Mayo Clinic

Teresa Wu
Arizona State University

Healthcare Logistics
Ali Ekici
University of Houston

INFORMS Journals
Esma Gel
Arizona State University

ICS-Advances in Optimization Modeling Languages & Systems
Ted Ralphs
Lehigh University

INFORMS Prize - 2012
Michael Gorman
University of Dayton

Job Placement Services
Bala Shetty
Texas A&M University

KINFORMS (Korea Chapter INFORMS)
Chang Won Lee
Hanyang University

INFORMS/SMDM Joint-Applications
Elisa Long
Yale School of Business

Steven Shechter
University of British Columbia

Managing Disruptions in Supply Chains
Ed Pohl
University of Arkansas

Chase Rainwater
University of Arkansas

New Product Development
Stelios Kavadias
Georgia Institute of Technology

Nicholson Student Paper Prize
Ashish Goel
Stanford University

O.R. in Emerging Economies
Goutam Dutta
Indian Institute of Management

M. R. Rao
Indian School of Business

Optimization in Finance
David Brown
Duke University

Project Management & Scheduling
Nicholas G. Hall
Ohio State University

Marc Posner
Ohio State University

Public Policy
Sheldon Jacobson
University of Illinois

Quantitative Finance
Kay Giesecke
Stanford University

Risk Management
Jussi Keppo
University of Michigan

Undergraduate O.R. Prize
Feryal Erhun
Stanford University

Workforce Management
Yun Fong Lim
Singapore Management University

Analytics
Michael Gorman
University of Dayton

Applied Probability
Vivek Farias
MIT

Ciamac Moallemi
Columbia University

Aviation Applications
Doug Fearing
Harvard Business School

Behavioral Operations Management
Brent Moritz
Penn State University

Computing Society
Ted Ralphs
Lehigh University

Computational Stochastic Optimization
Boris X. Defourny
Princeton University

CPMS, The Practice Section
Mary Grace Crissey
Pearson

Data Mining
Paul Brooks
Virginia Commonwealth University

Decision Analysis
Canan Ulu
University of Texas

Jagpreet Chhatwal
University of Pittsburgh

Alec Morton
London School of Economics

E-Business
Marius Niculescu
Georgia Tech

Mohammad Rahman
University of Calgary

Energy, Natural Resources & the Environment

Energy
Ramteen Sioshansi
Ohio State University

Ekundayo Shittu
Tulane University

Environment & Sustainability
Hayri Onal
University of Illinois

Forestry
Marc McDill
Pennsylvania State University

Mining
Marlize Meyer
Sasol

Alexandra Newman
Colorado School of Mines

Financial Services
Jim Bander
Toyota Financial Services

Health Applications
Vedat Verter
McGill University

Information Systems
Yong Tan
University of Washington

INFORM-ED
Susan E. Martonosi
Harvey Mudd College

Junior Faculty Interest Group
Elizabeth J. Durango-Cohn
Illinois Institute of Technology

Location Analysis
Stefan Nickel
Karlsruhe Institute of Technology

Erhan Kutanoglu
University of Texas

Manufacturing & Service Operations Management
Sang-Hyun Kim
Yale University

Robert Swinney
Stanford University

Healthcare Operations
Serhan Siya
University of North Carolina

iFORM
Rene Caldentey
NYU Stern School of Business

Onur Boyabatli
Singapore Management University

Service Operations
Ramandeep Ranhawa
University of Southern California

Supply Chain
Goker Aydin
Indiana University

Lauren Lu
University of North Carolina

Sustainable Operations
Deishan Lee
Harvard Business School

David Drake
Harvard Business School

Military Applications
William Fox
Naval Postgraduate School

Greg Parlier
Army Material Command

Minority Issues
Julie Ivy
North Carolina State University

Multiple Criteria Decision Making
Jyrki Wallenius
Aalto University School of Economics

Optimization
Jon Lee
University of Michigan

Computational Optimization & Software
Brian Borchers
New Mexico Tech

Global Optimization
Oleg Prokopyev
University of Pittsburgh

ICS- Derivative-Free & Surrogate Optimization
Nick Sahindis
Carnegie Mellon University

Christine Shoemaker
Cornell University

Integer Programming
Santanu Dey
Georgia Tech

Linear Programming & Complementarity
Mohammad Oskoorouchi
California State University San Marcos

Networks
Baski Balasundaram
Oklahoma State University

Nonlinear Programming
Frank Curtis
Lehigh University

Stochastic Programming
Huseyin Topaloglu
Cornell University

Organization Science
Andreas Schwab
Iowa State University

Public Programs, Service & Needs
Jessica L. Heier Stamm
Kansas State University

Mariel Lavieri
University of Michigan

Quality, Statistics & Reliability
Irad Ben-Gal
Tel Aviv University

Qiang Huang
University of Michigan

Railway Applications
Aihong Wen
CSX

Revenue Management & Pricing
Sumit Kunnumkal
Indian School of Business

Dan Zhang
University of Colorado

Service Science
Gregory Heim
Texas A&M University

Arjun Natarajan
IBM

Simulation
Bahar Biller
Carnegie Mellon University

Spreadsheet Productivity Research
Thomas G. Groleau
Carthage College

SpORts
Daniel Finkel
MIT

Technology Management
Leonardo Santiago
Universidade Federal de Minas Gerais

Telecommunications
Ivan Guardiola
Missouri S&T University

Tim Matis
Texas Tech University

Transportation Science & Logistics
Yi-Chang Chiu
University of Arizona

Facility Locations
Ananth Krishnamurthy
University of Wisconsin-Madison

Sadan Kulturel
Pennsylvania State University

Freight Transportation & Logistics
Yanfeng Ouyang
University of Illinois

Intelligent Transportation Systems (ITS)
Jeff X. Ban
Rensselaer Polytechnic Institute

Urban Transportation
Yueyue Fan
University of California-Davis

Wome0n in OR/MS
Laura McLay
Virginia Commonwealth University

Future INFORMS Meetings

INFORMS MEETINGS

2013

April 7-9
INFORMS Conference on Business Analytics & Operations Research
Grand Hyatt San Antonio
San Antonio, Texas
Chair: Jim Williams, Land O'Lakes, Inc.
http://meetings2.informs.org/analytics2013/

June 23-26
INFORMS Healthcare 2013
Chicago Marriott Downtown on Magnificent Mile
Chicago, Illinois
Chair: Sanjay Mehrotra, Northwestern University
http://meetings2.informs.org/healthcare2013/

July 1-4
EURO-INFORMS Joint International Meeting
Università di Roma - La Sapienza
Rome, Italy
Program Co-Chair: David Simchi-Levi, MIT
http://www.euro2013.org/

October 6-9
INFORMS Annual Meeting 2013 Minneapolis
Minneapolis Convention Center
Minneapolis, Minnesota
Chair: Robert G. Haight, U.S. Forest Service
http://meetings2.informs.org/minneapolis2013/

2014

April - dates & location to be announced
INFORMS Conference on Business Analytics & Operations Research

November 9-12 (NEW DATES)
INFORMS Annual Meeting 2014 San Francisco
Hilton San Francisco & Parc 55 Wyndham
San Francisco, California
Chair: Candace Yano, University of California-Berkeley
yano@ieor.berkeley.edu

2015

November 1-4
INFORMS Annual Meetings 2015 Philadelphia
Pennsylvania Convention Center & Marriott Philadelphia Downtown
Chair: Tamás Terlaky, Lehigh University
terlaky@lehigh.edu

INFORMS COMMUNITIES

2012

December 9-12
Winter Simulation Conference 2012
InterContinental Berlin
Berlin, Germany
Chair: Oliver Rose, Universität der Bundeswehr München
www.wintersim.org

2013

January 6-8
INFORMS Computing Society Conference
Eldorado Hotel
Santa Fe, New Mexico
Chair: William Hart, Sandia National Laboratories
www.informs.org/Community/Conferences/ICS2013

February 7-10
INFORMS Organization Science Winter Conference
Sheraton Steamboat Resort
Steamboat Springs, Colorado
Chair: Dan Levinthal
dlev@wharton.upenn.edu

June 6-7
INFORMS Revenue Management and Pricing Conference
Georgia Institute of Technology
Atlanta, Georgia
Chairs: Laurie Garrow, Necati Tereyagoglu
laurie.garrow@ce.gatech.edu

June 16-19
INFORMS Transportation Science & Logistics Workshop
Asilomar Conference Grounds
Pacific Grove, CA
Chair: Kevin Furman, ExxonMobil
Kevin.c.furman@exxonmobil.com

June 17-21
INFORMS Section on Group Decision & Negotiation Conference
Stockholm, Sweden
http://faculty.wwu.edu/lewis/gdn/gdn.htm

July 11-13
ISMS Marketing Science Conference
Swissôtel The Bosphorus
Istanbul, Turkey
Chair: Tulin Erdem, New York University
terdem@stern.nyu.edu

July 14-17
INFORMS Applied Probability Society Conference
Marriott Costa Rica
San Jose, Costa Rica
Chair: Emmanuel Fernandez, University of Cincinnati
http://www.informs.org/Community/APS/APS-Conferences

July 28-30
INFORMS MSOM Society Conference
INSEAD
Fontainebleau, France
Co-Chairs: Stephen Chick, Serguei Netessine, Francis de Vericourt, Enver Yucesan
http://msom.society.informs.org/conferences/

December 8-11
Winter Simulation Conference
JW Marriott
Washington, DC
Chair: Raymond Hill, Air Force Institute of Technology
www.wintersim.org

How to Navigate the Technical Sessions

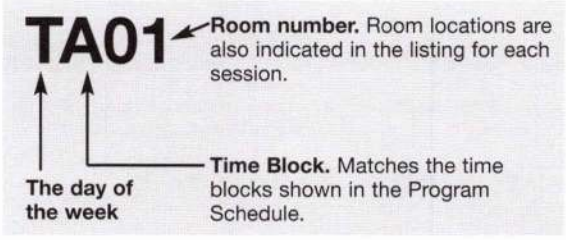
There are four primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Author and Session indices provide cross-reference assistance (pages 468-505).
- The floor plans on pages 42 and 43 show you where technical session tracks are located.

Quickest Way to Find Your Own Session

Use the Author Index (page 468) — the session code for your presentation will be shown along with the room location. You can also refer to the full session listing for the room location of your session.

The Session Codes



Time Blocks

Sunday - Tuesday

A — 8:00am - 9:30am
B — 11:00am - 12:30pm
C — 1:30pm - 3:00pm
D — 4:30pm - 6:00pm

Wednesday

A — 8:00am - 9:30am
B — 11:00am - 12:30pm
C — 1:30pm - 3:00pm
D — 3:20pm - 4:50pm

Room Locations /Tracks

All tracks and technical sessions will be held in the Phoenix Convention Center, and Hyatt Hotel. Room numbers are shown on the Track Schedule and in the technical session listing.

Sunday, 8:00am - 9:30am

■ SA01

01- West 101- CC

GRASP and Tabu Search

Contributed Session

Chair: Celso Ribeiro, Universidade Federal Fluminense, Institute of Computing, Niteroi, RJ, 22410240, Brazil, celso@ic.uff.br

1 - An Improved GRASP with Path Relinking for Commercial Districting

Roger Rios, Professor, Universidad Autonoma de Nuevo Leon, Graduate Program in Systems Engineering, AP 111-F, Cd. Universitaria, San Nicolas de los Garza, NL, 66450, Mexico, roger@yalma.fime.uanl.mx, Hugo Escalante

A commercial districting problem seeking to minimize territory dispersion under connectivity and multiple balancing constraints is addressed. A GRASP with path relinking (PR) is proposed. Both static and dynamic PR strategies are developed and assessed within a GRASP framework. Empirical work shows the effectiveness of the proposed method outperforming the best existing method in terms of solution quality.

2 - A Heuristic for a Real-world VRP Arising in a Bottled-beverage Distribution Company

Andrés Castrillón-Escobar, Student, UANL, Salvador Novo 105, Monterrey, Me, 64630, Mexico, cuatex1@hotmail.com, Roger Rios, J. Fabián Lopèz-Perèz

A real-world problem arising from the bottled-beverage distribution industry is addressed. The problem is modeled as a multi-depot pick-up and delivery capacitated VRP with additional side constraints such as time windows, non-homogeneous fleet, split delivery, and dock capacity, among others. To solve this problem, a GRASP is proposed. Empirical evidence on real-world very large instance is presented showing the proposed procedure improves current practice in terms of solution quality.

3 - Redundancy Allocation Problem of Complex System using Metaheuristics: A Computational Study

Jae-Hwan Kim, Professor, Korea Maritime University, Yeongdo-Gu Dongsam-Dong, Busan, Korea, Republic of, jhkim@hhu.ac.kr, Kil-Woong Jang

Redundancy allocation problem (RAP) is to select redundancy levels at each subsystem in order to maximize the system reliability under several resource constraints(e.g., cost). The RAP is a well-known NP-hard combinatorial optimization problem. We present some metaheuristics (tabu search, etc.) for its solution. A computational study for the composed test problems is also analyzed.

4 - Probabilistic Stopping Rules for GRASP Heuristics

Celso Ribeiro, Universidade Federal Fluminense, Institute of Computing, Niteroi, RJ, 22410240, Brazil, celso@ic.uff.br, Reinaldo Castro Souza, Isabel Rosseti

A drawback of most metaheuristics is the absence of effective stopping rules. We show experimentally that solution values obtained by GRASP fit a truncated Normal distribution and use this approximation to estimate the number of iterations needed to improve the best known solution. This estimation is used to implement stopping rules based on the trade-off between solution quality and computation time. This strategy is validated by results obtained for some GRASP heuristics.

5 - Evaluation of Run-length Distribution for CUSUM Charts under Gamma Distributions

Wenpo Huang, University of Macau, Faculty of Business Administration, Block1, B408, FBA, Taipa, Macau, China, wenpohuang@umac.mo, Lianjie Shu, Wei Jiang, Kwok Tsui

Numerical evaluation of run-length distributions of CUSUM charts under normal distributions has received considerable attention. However, accurate approximation of run-length distributions under non-normal or skewed distributions is challenging but has been previously overlooked. This paper provides a fast and accurate algorithm based on the piecewise collocation method for computing the run-length distribution of CUSUM charts under skewed distributions such as gamma distributions. It is shown that the piecewise collocation method can provide a more robust approximation of the run-length distribution than other existing methods such as the Gaussian quadrature based approach, especially when the process distribution is heavily skewed. Some computational aspects including alternative formulation based on matrix decomposition and geometric approximation of run-length distribution are discussed. Design guidelines of such CUSUM chart are also provided.

■ SA02

02- West 102 A- CC

Decision Analysis Applications in the Energy Industry

Sponsor: Decision Analysis

Sponsored Session

Chair: Mazen Skaf, Partner & Managing Director, Strategic Decisions Group, 745 Emerson St, Palo Alto, CA, 94301, United States of America, MSkaf@sdg.com

1 - A Decision Quality Approach to Natural Gas Resource Uncertainty

Robert Stibolt, Managing Director, Galway Group, L.P., 3050 Post Oak Blvd., Suite 1300, Houston, TX, 77056, United States of America, rstibolt@galwaygroup.com, Mazen Skaf

The shale gas revolution started in North America has completely changed the dynamic of world natural gas markets. Implications are far-reaching, exciting, but also highly uncertain. For example, the shape of long-run supply curves depend on technology, geology, and geopolitics. This paper addresses these questions within a framework that embraces uncertainty while eschewing the illusion of precise prediction — a key to developing natural gas strategies that are robust.

2 - Hydrocarbon Resource Allocation Strategy for Industry Development in an Energy-rich Nation

Mazen Skaf, Partner & Managing Director, Strategic Decisions Group, 745 Emerson St., Palo Alto, CA, 94301, United States of America, MSkaf@sdg.com, Thomas Seyller

We present a DA-based process and system for optimizing the allocation of supplies of a hydrocarbon resource across proposed industrial projects taking into account: i) uncertainty in future supply and demand, ii) various economic, social, and environmental value measures, and iii) existing commitments for current domestic uses and industries. The value-focused approach resulted in a paradigm shift in the industrial development strategy as well as in the future focus of E&P activities.

3 - Solar Value Chain Decision Analysis in Oil and Gas Rich Countries

Thomas Seyller, Sr. Engagement Manager, Strategic Decisions Group, 745 Emerson St., Palo Alto, CA, 94301, United States of America, tseyller@sdg.com, Dan Cornew

We will explore how decision analysis can help oil and gas rich countries develop strategies around solar energy that maximize the total benefit to the nation – including economic value and costs, social benefits such as job creation, and environmental impacts. Strategies cover a wide range of possible incentives and mandates throughout the solar value chain, from manufacturing to deployment.

■ SA03

03- West 102 B- CC

Risk and Uncertainty in Public Policy and Defense

Sponsor: Decision Analysis

Sponsored Session

Chair: Jay Simon, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Rd, Monterey, CA, 93943, United States of America, jrsimon@nps.edu

1 - Uncertainty Model for Rapid Updating of Target Positions

Eva Regnier, Naval Postgraduate School, 699 Dyer Road, Monterey, CA, 93943, United States of America, eregnier@nps.edu, Dashi Singham

In many security contexts, forces must allocate their assets based on incomplete information about targets' positions. They frequently receive human intelligence describing past or future events related to target locations. We present an uncertainty model that allows for rapid updating, conditioning on past or future events.

2 - Ranking FDA Risks: The Medical Devices Case

Robin Keller, University of California-Irvine, Irvine, CA, United States of America, lrkeller@uci.edu, Yitong Wang

This talk focuses on a medical devices case study. Keller served as a decision analyst on the committee charged with suggesting how the FDA can compare risks across product categories (foods, cosmetics, drugs, etc.). The NRC book proposed a multiple objective decision analytic approach to ranking risks: "A Risk-Characterization Framework for Decision-Making at the Food and Drug Administration" is at http://dels.nas.edu/Report/Risk-Characterization-Framework-Decision/13156.

3 - Probability Segmenting: Managing Uncertainty in Military Drafts

Jay Simon, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Rd, Monterey, CA, 93943, United States of America, jrsimon@nps.edu, Jonathan Lipow

When a nation chooses to enact a draft, this presents an interesting decision problem for those individuals eligible to be drafted: they can take actions which, at some cost, will reduce the probability of being selected. It is in society's best interest to minimize these costly actions. We discuss "probability segmenting," the idea of randomly assigning different probabilities to different individuals, as a possible method for improving the outcome at a societal level.

■ SA04

04- West 102 C- CC

Advances in Decision Analysis

Contributed Session

Chair: Steven Kimbrough, Professor, University of Pennsylvania, 3730 Walnut St., Philadelphia, PA, 19104, United States of America, kimbrough@wharton.upenn.edu

1 - Extending the Multiscale Decision-making Model: From Two to Many Decision Alternatives

Swathi Sudhaakar, Graduate Student, Virginia Tech, 116 Durham Hall, MC 0118, Blacksburg, VA, 24061, United States of America, swathips@vt.edu, Christian Wernz

We generalize the multiscale decision making model by extending the agents' action space from two to N decision alternatives. Multiscale decision theory (MSDT) models the interaction and decision interdependencies of agents in large enterprise systems. With our results, MSDT can now be applied to a wider range of applications and provides organizational and system designers with insights on how the number of decision alternatives affects agents' decision processes.

2 - On the Axiomatization of the Satiation and Habit Formation Utility Models

Ying He, PhD Candidate, University of Texas at Austin, Department Information, Risk & Operational Mg, 1 University Station, B6000, Austin, TX, 78712, United States of America, ying.he08irom@utexas.edu, James Dyer, John Butler

We propose a preference condition called shifted difference independence to axiomatize a general habit formation and satiation (GHS) model. Since the GHS model can be reduced to either a general satiation model (GSa) or a general habit formation model (GHa), our theory also provides approaches to axiomatize both the GSa and the GHa model. By adding extra preference conditions, we axiomatize a GHS model with a linear habit function and a linear satiation function.

3 - Strategic Experimentation under Exclusivity

Stefan Rampertshammer, Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27516, United States of America, Stefan.Rampertshammer@duke.edu

We study a model of strategic experimentation with exponential bandits in which we attach a prize and a level of exclusivity to the first success. We determine the socially optimal policy, examine equilibrium behavior, and show that the efficient outcome can be recovered in dominant strategy through a combination of exclusivity and prizes.

4 - Solution Pluralism

Steven Kimbrough, Professor, University of Pennsylvania, 3730 Walnut St., Philadelphia, PA, 19104, United States of America, kimbrough@wharton.upenn.edu, Frederic Murphy

Solution pluralism involves generating a plurality of optimal and near-optimal solutions for use by stakeholders. Modern heuristics and ever-advancing computational powers make solution pluralism a practicable approach to explore for near optimal solutions as a form of sensitivity analysis and multiple candidate solutions when the problem has multiple objectives. We discuss the concept and principles of solution pluralism and illustrate it with a real world application to electoral districting.

■ SA05

05- West 103 A- CC

Journal of Quality Technology Invited Papers

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Daniel Apley, NorthWestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, apley@northwestern.edu

1 - Bayesian Modeling and Optimization of Functional Responses Affected by Noise Factors

Enrique del Castillo, Distinguished Professor, Department of Industrial & Manufacturing Engineering & Department of Statistics, Penn State University, University Park, PA, United States of America, exd13@psu.edu, Bianca M. Colosimo, Hussam Alshraideh

We present a Bayesian predictive modeling approach for functional response systems. The goal is to optimize the shape, or profile, of the functional response under a robust parameter design scenario in which there are controllable and noise factors. The method is illustrated with real examples and model building and diagnostics aspects of the assumed mixed effects model are discussed. Alternative modeling strategies beyond those in the JQT paper (2012, 44(2)) will be presented.

2 - Robust Leak Tests for Transmission Systems using Nonlinear Mixed-Effect Models

Kamran Paynabar, University of Michigan, Ann Arbor, MI, United States of America, kamip@umich.edu, Judy Jin, John Agapiou, Paula Deeds

Leakage of the transmission fluid or oil in powertrain systems can cause engine overheating and/or permanent damages. The inspection results of the amount of leakage at given testing times are sensitive to the tested part's temperature, which varies from part to part but was not previously incorporated in the leak testing systems. The objective of this paper is to develop a robust leak testing system using nonlinear mixed-effect models, which is insensitive to the part temperature variations.

3 - A Variable-Selection-based Multivariate EWMA Chart for Process Monitoring and Diagnosis

Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Beijing, China, kbwang@tsinghua.edu.cn, Wei Jiang, Fugee Tsung

Fault detection and root cause identification are both important tasks in Multivariate Statistical Process Control. This paper proposes a Variable-Selection-based MEWMA chart. The new chart first locates potentially out-of-control variables via variable selection, and then deploys such information in the monitoring statistics with the reduction in dimensionality providing increased sensitivity to out-of-control conditions. Its performance is studied via numerical simulations and real examples.

■ SA06

06- West 103 B- CC

Efficient Learning in Stochastic Optimization

Sponsor: Simulation

Sponsored Session

Chair: Ilya Ryzhov, University of Maryland, 4322 Van Munching Hall, College Park, MD, 21044, United States of America, iryzhov@rhsmith.umd.edu

1 - Dynamic Pricing under a General Parametric Choice Model

Paat Rusmevichientong, Associate Professor, University of Southern California, Marshall School of Business, rusmevic@marshall.usc.edu, Josef Broder

We consider a stylized dynamic pricing model in which a monopolist prices a product to a sequence of customers, who independently make purchasing decisions based on the price offered according to a general parametric choice model. The parameters of the model are unknown to th e seller, whose objective is to determine a pricing policy that minimizes the regret. We characterize the regret profile for this problem.

2 - Kernelized Approximate Linear Programming

Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vivekf@mit.edu, Ciamac Moallemi, Nikhil Bhat

We present a practical, non-parametric ADP algorithm that enjoys graceful, dimension-independent approximation and sample complexity guarantees by 'kernelizing' a recent mathematical program for ADP (the 'smoothed' approximate LP). A computational study on a controlled queueing network shows that our procedure is competitive with state of the art parametric ADP approaches that employ carefully tailored approximation architectures.

3 - Sequential Filtering of Glaucoma Progression

Jonathan Helm, Assistant Professor, Indiana University, Kelley School of Business, ODT, 1309 East Tenth Street, Bloomington, IN, 47405, United States of America, jhelm@umich.edu, Mariel Lavieri, Mark Van Oyen, Joshua Stein, MD

We develop novel filtering algorithms for monitoring the disease progression of glaucoma patients. The models are validated using patient data from two multi-center clinical trials.

4 - Ranking and Selection with Unknown Correlation Structures

Huashuai Qu, University of Maryland, College Park, MD, United States of America, huashuai@math.umd.edu, Ilya Ryzhov, Michael Fu

We create the first computationally tractable Bayesian statistical model for learning unknown correlations among alternatives in fully sequential ranking and selection. We can learn the unknown values and unknown correlations simultaneously with the model. A Bayesian procedure is derived to allocate simulations based on the value of information. We test the model and algorithm in a simulation study motivated by the problem of optimal wind farm placement, and obtain encouraging empirical results.

■ SA07

07- West 104 A- CC

Joint Session DM/HAS: Data Mining in Health Care

Sponsor: Data Mining & Health Applications Society

Sponsored Session

Chair: Shengfan Zhang, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, shengfan@mail.uark.edu

1 - Analyzing Human Microbiome Data

Paul Brooks, Assistant Professor, Department of Statistical Sciences and Operations Research, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23284, United States of America, jpbrooks@vcu.edu, Microbiome Consortium

The human microbiome is the community of microbes that populate habitats on and around various body sites. Advances in high-throughput sequencing facilitate investigations into the impact of the microbiome on physiology and disease. Microbiome data presents unique challenges for analysis. In this talk, we present methods for analysis that seek to address some of these challenges.

2 - Outcome and State Transition Modeling for Adaptive Interdisciplinary Pain Management

Aera LeBoulluec, PhD Student/GRA, University of Texas-Arlington, 2205 Hunter Place Lane, Arlington, TX, 76006, United States of America, aera.leboulluec@mavs.uta.edu, Li Zeng, Victoria Chen

In this research, we seek adaptive treatment strategies for interdisciplinary pain management using data from the Eugene McDermott Center for Pain Management at the University of Texas Southwestern Medical Center at Dallas. An adaptive dynamic programming approach is formulated to improve current and future pain outcomes. Outcome and state transition modeling handle the problem of endogeneity via an inverse probability of treatment weighting approach.

3 - Machine Learning with Operational Costs

Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Theja Tulabandhula

We aim to merge theway estimation algorithms are designed with how they are used for a subsequent task. We consider the operational cost of carrying out a policy, based on a predictive model. The operational cost becomes a regularization term in the learning algorithm's objective, allowing either an optimistic or pessimistic view of possible costs. Limiting the operational cost reduces the hypothesis space, and can thus improve generalization. We bound the complexity of such hypothesis spaces.

4 - Predictive Modeling of Glycosylation Modulation Dynamics in Cardiac Electrical Signaling

Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

The cardiac action potential is produced by the orchestrated functions of ion channel dynamics. This investigation is aimed at modeling the variations of cardiac electrical signaling due to remodeling of a K+ channels. This multi-scale modeling investigation reveals novel mechanisms of hERG channel modulation by regulated glycosylation that also impact cardiac myocyte and tissue functions. It can potentially lead to new pharmaceutical treatments and drug designs for cardiac arrhythmia.

■ SA08

08- West 104 B- CC

Inventory Management for Global Health

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Jeremie Gallien, London Business School, Regent's Park, London, NW14SA, United Kingdom, jgallien@london.edu

1 - Improving the Public Distribution of Essential Medicines in Sub-Saharan Africa: The Case of Zambia

Zachary Leung, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA, United States of America, zacleung@mit.edu, Jeremie Gallien, Prashant Yadav

Despite remarkable and successful improvements efforts by the government and its partners, the current public distribution system of essential medical drugs in Zambia still results in low availability to patients relative to private sector standards. We present an alternative design involving mobile devices and optimization and evaluate this proposal via a simulation model built with field data. Our results suggest that this proposal would improve drug availability and reduce inventory costs.

2 - Malaria Treatment Distribution in Developing World Health Systems and Application to Malawi

Hoda Parvin, Research Analyst, CNA, 4825 Mark Center Dr., Alexandria, VA, 22311, United States of America, parvinh@cna.org, Shervin AhmadBeygi, Mark Van Oyen, Peter Larson, Jonathan Helm

We present stochastic models to address malaria treatment distribution in developing world under demand uncertainty. We first analyze a two-stage stochastic programming approach to make aggregate-level nation-wide decisions. We then present a Markov decision model to develop operational-level transshipment strategies within a cluster of clinics.

3 - Public Health Impact of the Global Fund's Performance-based Financing Process: A Queueing Analysis

Iva Rashkova, London Business School, London, United Kingdom, irashkova.phd2009@london.edu, Jeremie Gallien, Prashant Yadav

The Global Fund is the largest financier of programs against HIV, Malaria and Tuberculosis. We study its disbursement process through (i) an econometric analysis of disbursement and procurement data between 2003 and 2012; and (ii) a queueing model predicting national stock levels of medicines. This model quantifies the impact of the current process on central drug availability in 48 African countries and potential interventions that include bridge financing and an international buffer stock.

4 - Inventory Management in Humanitarian Supply Chains: The Role of Schedules and Uncertainty in Funding

Karthik V. Natarajan, University of North Carolina, Chapel Hill, NC, United States of America, karthik_natarajan@unc.edu, Jayashankar M. Swaminathan

Motivated by the ready-to-use therapeutic food (RUTF) supply chain in Africa, we study the problem of managing inventory of a nutritional product in the presence of variable funding constraints. We derive the structure of the optimal inventory and allocation policy and computationally analyze the impact of different funding schedules on the operating costs andwaiting times in the system.

■ SA09

09- West 105 A- CC

Evolutionary Multi-Criterion Optimization - I

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Kalyanmoy Deb, Professor, Indian Institute of Technology Kanpur, Department of Mechanical Engineering, Kanpur, UP, 208016, India, deb@iitk.ac.in

1 - A Decentralized Bicriteria Timeshare Exchange Algorithm

Bahriye Cesaret, PhD Student, Jindal School of Management, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, bahriye.cesaret@utdallas.edu, Milind Dawande, Tharanga Rajapakshe

Timeshare Exchange refers to the trading of vacation timeshare weeks among owners, so that they can interchange their respective vacation homes and thereby experience new destinations. We consider two objectives to capture the notions of "efficiency" and "fairness" in an exchange solution. Our main contributions include (i) a structural analysis of the resulting bicriteria timeshare exchange problem and (ii) a polynomial-time, decentralized algorithm for "good" bicriteria solutions.

2 - Cooperative Surrogate Models Improving Multi-objective Evolutionary Algorithms

Saúl Zapotecas Martìnez, CINVESTAV-IPN, Mexico, D.F., Mexico, saul.zapotecas@gmail.com, Carlos A. Coello Coello

We present a multi-objective evolutionary algorithm (MOEA) assisted by two different meta-models: a local and a global one. The global model is constructed by using different surrogate models. The local model is generated by using the solutions in the current population of the MOEA. The training set for each model is updated along the search of the MOEA. The two different predicted values of the functions provided by the meta-models are used to estimate the final value of each function.

3 - Diversity Enhancing Evolutionary Multiobjective Search

Brian Piper, North Carolina State University, 2500 Stinson Drive, Raleigh, NC, United States of America, bepiper@ncsu.edu, Ranji Ranjithan, Hana Chmielewski

Besides obtaining Pareto-optimal solutions, decision diversity is an important consideration in real-world multiobjective problems. Diversity can be defined as both the spread of solutions in the decision space and degree to which alternative solutions are available. We present algorithms for obtaining diverse Pareto-optimal sets and compare results for several test problems to demonstrate the effectiveness of the algorithms.

4 - Satisfying Multiple Objectives in Infrastructure Management Planning

Hana Chmielewski, North Carolina State University, Campus Box 7908, Raleigh, NC, United States of America, htchmiel@ncsu.edu, Ranji Ranjithan

Evolutionary algorithms lend themselves to solving cross-disciplinary problems with multiple objectives. In infrastructure planning, for example, it may be useful to consider the resource and performance objectives of engineers, land-use planners, and emergency managers. An algorithm that offers maximally different non-inferior management plans by preserving the diversity of solutions in the decision space is applied to aid decision-making inwastewater treatment planning.

■ SA10

10- West 105 B- CC

Risk in Stochastic Programming

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Sitki Gulten, PhD Candidate, Rutgers University, Department of Management Science & Infor, 1 Washington Park, Newark, NJ, 07102, United States of America, sgulten@rutgers.edu

1 - Two-stage Portfolio Optimization with Higher-order Conditional Measures of Risk

Sitki Gulten, PhD Candidate, Rutgers University, Department of Management Science & Infor, 1 Washington Park, Newark, NJ, 07102, United States of America, sgulten@rutgers.edu, Andrzej Ruszczynski

Optimization of a portfolio with an option to rebalance over multiple periods from is a major problem in modern portfolio theory. In this research, different forward and backward scenario tree generation techniques are applied on multivariate GARCH-generated scenarios to construct scenario trees. Next, mean-

semideviation risk function with higher-orders is used to formulate the two-stage portfolio problem in which there are two periods and an option to rebalance between those two periods.

2 - Complexity of Bilevel Coherent Risk Programming
Jonathan Eckstein, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu

We describe a bilevel programming approach to applying coherent risk measures to three-stage stochastic programming problems. This formulation technique avoids the time-inconsistency difficulties of naive models and the incomposability issues causing time-consistent formulations to have complicated, hard-to-explain objective functions. Unfortunately, we show that such bilevel formulations, when using the standard mean-semideviation and average-value-at-risk measures, are NP-hard.

3 - Scenario Generation and Reduction Applied to Long-term Power Generation Expansion Planning with Risk
Yonghan Feng, Iowa State Univseristy, 3024 Black Engr, Ames, IA, United States of America, yhfeng@iastate.edu, Sarah Ryan

A stochastic program minimizes the combined expected cost and CVaR of long term power generation expansion planning. Scenarios are generated from stochastic process models of demand and natural gas price and then reduced by a new heuristic called forward selection in wait-and-see clusters (FSWC). Numerical results in a twenty-year case study indicate substantial computational savings while identifying similar solutions as those obtained by applying forward selection alone.

■ SA11

11- West 105 C- CC

Advances in Stochastic Programming

Contributed Session

Chair: Alper Murat, Assistant Professor, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, amurat@wayne.edu

1 - Simulation-based Two-stage Stochastic Programming with Recourse and Endogenous Uncertainty
Tahir Ekin, PhD Candidate, The George Washington University Department of Decision Sciences, 2201 G St Funger Hall 415 NW, Washington, DC, 20052, United States of America, ekin@gwu.edu, Refik Soyer, Nicholas Polson

We consider two stage stochastic recourse problems with decision dependent (endogenous) uncertainty. We develop an augmented probability simulation approach via Markov Chain Monte Carlo methods. Our approach is illustrated with a production planning problem involving continuous uncertainty and continuous first stage decision variables.

2 - A New Algorithm for Moment-matching Scenario Generation with Application to Financial Optimization
Diana Roman, Brunel University, Uxbridge, London, United Kingdom, diana.roman@brunel.ac.uk, Paresh Date, Ksenia Ponomoreva

This method produces scenarios that match exactly the given first moment, covariance matrix, average marginal skewness and kurtosis of a random vector. Unlike previous approaches, it does not use optimization in the scenario generation process; thus it is computationally much simpler. We generate scenarios for a portfolio optimization model. Desirable properties are satisfied, e.g. in and out-of-sample stability. Optimal solutions vary only marginally with increasing number of scenarios.

3 - Progressively Hedged Sample Average Approximation for Two-stage Stochastic Programs
Alper Murat, Assistant Professor, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, amurat@wayne.edu, Nezir Aydin

We present a novel hybrid heuristic method (PHSAA) for solving two-stage stochastic programs which integrates deterministic Progressive Hedging method with Sample Average Approximation. PHSAA improves over SAA by exploiting sample solution information and reducing the need to use large sample sizes. PHSAA is significantly more efficient than SAA while attaining same or better solution quality than SAA. We report on extensive results using capacitated reliable facility location problem (CRFLP).

■ SA12

12- West 106 A- CC

Recent Advances in Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Sebastian Pokutta, Friedrich-Alexander-Universitat Erlangen-Nürnberg, Cauerstrasse 11, Erlangen, 91058, Germany, sebastian.pokutta@me.com

1 - Solving Mixed-Integer Semidefinite Programs
Lars Schewe, Dr., FAU Erlangen-Nürnberg, Cauerstr. 11, Erlangen, 91058, Germany, lars.schewe@math.uni-erlangen.de, Sonja Mars

We present practical solution approaches to solve mixed-integer semidefinite programs: We show that by integrating standard semidefinite solvers into the mixed-integer solver SCIP, we can harness standard methods from integer programming. We present computational results on a variety of instances.

2 - Comparing Symmetry Breaking Techniques
James Ostrowski, University of Tennessee, 1425 S. Stadium Dr, Knoxville, TN, 37996, United States of America, jostrows@utk.edu

There are a variety of ways to break symmetry in an MILP problem. We will discuss several of these methods, and test them on a variety of highly symmetric problems.

3 - The Structure of Reduced Bases for Kernel Lattices
Karen Aardal, Delft University of Technology, Mekelweg 4, Delft, 2628 CD, Netherlands, K.I.Aardal@tudelft.nl, Frederik von Heymann, Andrea Lodi

We consider the structure of reduced bases for lattices consisting of all integer vectors belonging to the null space of a positive integer vector. We observe that when the length is measured as the Euclidean distance, as in the standard implementation of the LLL algorithm, then the reduced basis has an Identity matrix as a submatrix. We provide a theoretical analysis, implications, and computational illustrations.

4 - The Structure of Reduced Bases for Kernel Lattices: Theoretical Analysis
Frederik von Heymann, Delft University of Technology, Mekelweg 4, Delft, 2628 CD, Netherlands, f.j.vonheymann@tudelft.nl, Karen Aardal, Andrea Lodi, Laurence Wolsey

In this presentation we continue on the topic of the previous talk. Here we present the main ingredients of the theoretical analysis and give some computational examples.

■ SA13

13- West 106 B- CC

Stochastic Integer Programming Applications

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Burak Buke, The University of Edinburgh, School of Mathematics, King's Buildings, JCMB, Edinburgh, United Kingdom, B.Buke@ed.ac.uk

1 - A Novel Scenario Reduction Method for Two-stage Stochastic Programs
Ali Koc, IBM Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, akoc@us.ibm.com

We present a novel scenario reduction method for two-stage stochastic programs. The objective is to minimize the bound on the worst case performance of the optimal value of the reduced problem under the original problem. The method considers both the uncertainty and the underlying optimization problem, as opposed the methods that just consider the uncertainty. We show that both the theoretical bounds and the numerical results obtained by the method are tighter than the methods in literature.

2 - Reclaimed Water Network Design via Stochastic Integer Programming
Weini Zhang, Systems and Industrial Engineering, University of Arizona, Tucson, AZ, 85721, United States of America, wzhang@email.arizona.edu, Guzin Bayraksan, Gunhui Chung, Kevin Lansey

We model a reclaimed water distribution network for supplying treated water to the public users or agricultural areas using two-stage stochastic binary programming with random recourse. Both construction and energy costs expanded are considered. The network has spatial growth and reclaimed water demands are uncertain. A specialized algorithm is developed to exploit the

structure of the network to efficiently solve the problem. Computational results are presented on a realistic problem.

3 - Managing Capacity Flexibility in Make-to-Order Production Environments

Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl, David Morton, Douglas Morrice

We address the problem of managing flexible production capacity in an MTO manufacturing environment. We present a multi-period capacity management model where we distinguish between process and operational flexibility. Our results reveal that myopic policies may lead a firm to adopt more process flexibility. That is, process flexibility may be over-valued in the literature since it is assumed that a firm will operate optimally after the process flexibility decision.

4 - Cross-training with Imperfect Training Schemes

Burak Buke, The University of Edinburgh, School of Mathematics, King's Buildings, JCMB, Edinburgh, United Kingdom, B.Buke@ed.ac.uk, Ozgur Araz, John Fowler

Cross-training is an efficient way to achieve flexibility. We assume that training can be online as demand is revealed, in addition to the offline training before demand is realized. We show that if online training is as effective as offline schemes, offline training decreases as variability increases. If the effectiveness of online and offline schemes differ, offline training may increase as variability increases. We also provide a stochastic integer program to design cross-training schemes.

■ SA14

14- West 106 C- CC

Advances in Project Management

Contributed Session

Chair: Bruce Pollack-Johnson, Associate Professor of Mathematics & Statistics, Villanova University, 800 Lancaster Avenue, Department of Mathematics & Statistics, Villanova, PA, 19085, United States of America, bruce.pollack-johnson@villanova.edu

1 - Multi-player Project Planning and Scheduling under Risk Sharing

Xin Xu, Rutgers University, 425 Mount Prospect Ave., Apt. 417, Newark, NJ, 07104, United States of America, xin.xu.2009@rutgers.edu, Yao Zhao

We consider a product development project where the design work of subsystems is outsourced to suppliers by a manufacturer. We build a mathematical model to predict each firm's behavior under a risk sharing partnership. We show that each firm tends to delay its task relative to what is the best for the entire project as a whole. We propose an alternative incentive scheme – fair sharing, to remedy the weakness of risk sharing while retaining its benefits.

2 - Optimizing Team Staffing Decisions: Meeting Performance Expectations When Staffing One or Many Teams

Alison Schroeder, Purdue University, 315 N Grant St., West Lafayette, IN, 47907, United States of America, schroe32@purdue.edu, Sara McComb, Deanna Kennedy

Staffing project teams from a pool of candidates with similar skills and abilities is not trivial. Moreover, managers may want to staff one team or many teams from the pool. Herein we optimize the personality-performance relationship model to determine team assignments that fulfill managerial performance expectations. Implications are discussed.

3 - The Impact of Reputation on Project Selection

Ali Shafahi, Graduate Student, University of Maryland at College Park, Dept. of Civil & Environmental Eng., 1173 Glenn L. Martin Hall, College Park, MD, 20740, United States of America, ashafahi@umd.edu, Ali Haghani, Masoud Hamedi

Contractor's reputation is one of the contributing factors in project selection. This study takes advantage of an optimization model that considers monetary as well as non-monetary criteria. To investigate relative importance of reputation to profit on the project selection decision, the model is applied to a set of sample problems. The decision making framework and results of sensitivity analysis are presented.

4 - Project Planning and Scheduling to Maximize Quality in the Presence of Cost Overruns and Time Delays

Bruce Pollack-Johnson, Associate Professor of Mathematics & Statistics, Villanova University, 800 Lancaster Avenue, Department of Mathematics & Statistics, Villanova, PA, 19085, United States of America, bruce.pollack-johnson@villanova.edu, Matthew Liberatore

We present research designed to help deal with significant cost overruns and time delays. In such circumstances the overall quality of a project is most likely to suffer. We present strategies for dealing with such undesirable situations to minimize the reduction in the overall project quality by applying different project planning and scheduling models that evaluate the tradeoffs between quality, time, and cost.

■ SA15

15- West 202- CC

Software Demonstration

Invited Session

1 - AMPL Optimization - Specifying "Logical" Conditions in AMPL Optimization Models

Robert Fourer, President, AMPL Optimization, Inc, 2145 Sheridan Road, Evanston IL, United States of America, 4er@ampl.com

Optimization modelers are often stymied by the complications of converting problem logic into algebraic constraints suitable for solvers. The AMPL modeling language thus allows various logical conditions to be described directly. Additionally a new interface to the ILOG CP solver handles logic in a natural way not requiring conventional transformations.

2 - Palisade Corporation - Avoiding Failure: using @RISK to Identify, Analyze and Manage Risk More Successfully

Rafael Hartke, Oil and Energy Industry Consultant, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY 14850, United States of America, dsprague@schwartzmsl.com

Projects fail. They often fail for a lack of effective planning, either because of excess optimism in terms of time, cost and performance or because of extra work in the plan in terms of scope, resources and unforeseen events. @RISK employs Monte Carlo based simulation to give insight through sophisticated statistical analysis of the various potential outcomes. Understanding range outcomes facilitates effective risk management, prioritizing critical risks and managing expectations.

■ SA16

16- West 207- CC

Multiple Criteria Decision Making: Foundations and Some Approaches

Cluster: Tutorials

Invited Session

Chair: Murat Köksalan, METU, IE Department, METU, Ankara, Turkey, koksalan@ie.metu.edu.tr

1 - Multiple Criteria Decision Making: Foundations and Some Approaches

Murat Köksalan, METU, IE Department, METU, Ankara, Turkey, koksalan@ie.metu.edu.tr, Jyrki Wallenius

In this tutorial we cover the foundations of Multiple Criteria Decision Making and define and demonstrate basic concepts. We classify approaches based on the problem structure as well as on the way decision maker's preferences are elicited. We discuss some approaches, emphasizing the interactive approaches. We demonstrate the concepts and approaches together with illustrative examples and graphs and we provide information about further resources and references.

■ SA17

17- West 208 B- CC

Stochastic Programming with Random or Ambiguous Data

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48103, United States of America, siqian@umich.edu

1 - Models and Algorithms for the Balance-Constrained Stochastic Bottleneck Spanning Tree Problem
Jue Wang, Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, juewang@umich.edu, Siqian Shen, Murat Kurt

This paper studies chance-constrained formulations of the BCSBSTP with independently distributed arc weights, and reformulates them as MINLPs. We employ SOS1 and SOS2 variables to approximate nonlinearity with linear constraints, and compare the results with an SAA-based MIP reformulation of the orignal problem. In general, SOS1 computationally performs better than the other two approximation approaches, tested on random network instances with various distribution settings of arc weights.

2 - Target Oriented Optimization in Inventory Management
Zhuoyu Long, NUS Business School, Singapore, longzhuoyu@nus.edu.sg, Lucy Gongtao Chen, Georgia Perakis, Melvyn Sim

In this study we investigate the impact of target on both one-period and multi-period inventory management problems. We develop target-oriented decision criteria to model the effect of target. For the one-period (newsvendor) problem, the result from our theoretical model is consistent with experimental findings. For the multi-period problem, we incorporate the financing decisions, and report favorable computational results for using targets in regulating uncertain consumptions over time.

3 - Data-driven Chance Constrained Stochastic Program
Ruiwei Jiang, University of Florida, 411 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, rwjiang@ufl.edu, Yongpei Guan

Chance constraint is a convenient modeling tool of decision making under uncertainty. In practice, instead of knowing the true distribution of a random parameter, only a series of historical data sampled from the ambiguous distribution are available. In this talk, we develop exact approaches to reformulate the Data-driven Chance Constraints (DCC) based on historical data.

■ SA18

18- West 208 A- CC

Applied Network Optimization Methodologies

Contributed Session

Chair: Isil Kirkizoglu, Middle East Technical University, Industrial Engineering Department, Ankara, 06800, Turkey, isilkirkizoglu@gmail.com

1 - A New Branch & Bound Approach for the Traveling Repairman Problem
Stefan Bock, Professor, Chair of Business Computing and Operations Research, University of Wuppertal, Gaußstraße 20, Wuppertal, Germany, sbock@winfor.de

This talk studies a special case of the well-known Traveling Repairman Problem. Specifically, while processing times at the customer locations are neglected, each customer has to be serviced not before a predetermined release date and, depending on the considered problem variant, not after a given due date. In order to solve the problem, a new best first Branch&Bound approach is proposed. Its efficiency is validated by means of computational tests.

2 - Travelling Salesman Problems in Dynamic Environment
Eran Simhon, Technion, Technion City, Haifa, HA, 32000, Israel, simhon@bu.edu, Shraga Shoval, Liron Yedidsion

In the last 20 years there has been a growing interest in the field of Moving Target Traveling Salesman Problem (MT-TSP), in which targets move at fixed velocities. In this research we study the Resupply MT-TSP, in which the agent must visit the origin after each interception. We prove that the offline version is strongly NP-hard and that the online version is unbounded. We also show the equivalence of special cases of the problem to scheduling problems with deteriorating jobs.

3 - Benders Decomposition for a Splitter Location-allocation Problem in Fiber Optic Access Networks
Sachin Jayaswal, Assistant Professor, Indian Institute of Management Ahmedabad, Vastrapur, Ahmedabad, Gu, 380015, India, sachin@iimahd.ernet.in, Astha Airan

We propose a Benders Decomposition based algorithm to solve the Splitter Location-Allocation Problem in Fiber Optic Access Networks. Our numerical results are very encouraging: our proposed Benders Decomposition helps achieve the optimal solution for large problem instances in couple of seconds which CPLEX is unable to solve using the original MIP model even in an hour.

4 - Parametric Programming Approach to Gene Expression Clustering using the Clique Partitioning Problem
Victoria Ellison, North Carolina State University, Raleigh, NC, 27605, United States of America, vmelliso@ncsu.edu, Yahya Fathi, Yoshitsugu Yamamoto, Amy Langville

We introduce a parametric programming based algorithm to solving a binary integer linear programming (BILP) formulation of the Clique Partitioning Problem, for the purpose of gene expression clustering. We derive various structural properties regarding the existence and optimality of binary solutions to the linear relaxation of the BILP. Using linear programming sensitivity analysis we derive a measure of closeness between patients of similar and different disease subtypes.

5 - Discretization for Heat Exchanger Network Design with Equipment Configuration
Isil Kirkizoglu, Middle East Technical University, Industrial Engineering Department, Ankara, 06800, Turkey, isilkirkizoglu@gmail.com, Haldun Sural, Sinan Gurel

This study presents an optimization approach to a chemical engineering process design problem. We propose a flexible solution approach for heat exchanger network design with detailed equipment configuration. It involves discretization of temperatures based on heat load equality and formulation of a shortest-path problem rather than dealing with nonlinearity at the network design level, a common method in the literature. Computational results are provided.

■ SA19

19- West 211 A- CC

Joint Session Healthcare Logistics/SPPSN: Vehicle Routing in Healthcare Applications

Cluster: Healthcare Logistics & Public Programs, Service and Needs
Invited Session

Chair: Ali Ekici, University of Houston, Department of Industrial Engineering, Houston, TX, United States of America, aekici@central.uh.edu

1 - A Constant-factor Approximation Algorithm for Multi-vehicle Collection for Processing Problem
Lerzan Ormeci, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, LORMECI@ku.edu.tr, Esma Gel, Sibel Salman, Eda Yucel

In multiple vehicle collection for processing problem, items accumulate at a set of sites and are transferred through a series of tours of multiple vehicles to a processing facility to be processed. We show that the problem with the makespan objective is NP-hard, and propose a polynomial-time, constant-factor approximation algorithm for its solution.

2 - Managing Blood Collection Operations
Ali Ekici, University of Houston, Department of Industrial Engineering, Houston, TX, United States of America, aekici@central.uh.edu, Orsan Ozener, Gultekin Kuyzu

In this paper, motivated by the practices in blood supply management, we study a variant of the vehicle routing problem. Considering processing requirements of donated whole blood in order to extract platelets, we analyze the pickup operations from donation centers and develop algorithms to maximize the platelet production.

3 - A New Approach for Routing Courier Delivery Services with Urgent Demand
Chen Wang, University of Southern California, University Park Campus, Los Angeles, CA, 90007, United States of America, Wang20@usc.edu, Fernando Ordonez, Maged Dessouky

The courier delivery industry is faced with random demand, as well as urgent requests. An example of such application is the transportation of medical specimens. We propose better vehicle routing solutions that can efficiently satisfy random demand and urgent requests. We formulate a multi-trip vehicle routing problem, and devise a heuristic based on insertion and Tabu search. Simulations on randomly generated data and on real-world data show significant improvement from existing methods.

■ SA20

20- West 211 B- CC

Joint Session: SPPSN/ENRE-Environment: Energy Policy and Sustainability

Sponsor: Public Programs, Service and Needs & Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Erin Baker, University of Massachusetts, Amherst, MA, United States of America, edbaker@ecs.umass.edu

1 - Decommissioning and Repowering Decisions for Renewable Power Producers

Chenlu Lou, Iowa State University, 3004 Black, Ames, IA, 50011, United States of America, clou@iastate.edu, K. Jo Min

There have been substantial increases in the construction and operation of wind farms across the U.S.A. and the world, which will lead to a significant number of wind farm decommissioning and repowering decisions soon. We formulate and analyze mathematical models from a real options perspective with the operation and maintenance cost following the geometric Brownian motion process, and derive managerial insights for relevant government policy makers.

2 - Hydrogen Production Facility Network Design from Stochastic Green Energy Supply Source

Jorge Barnett Lawton, Zaragoza Logistics Center, C/ Bari 55, Plaza, Edificio Nayade, Portal 5, Zaragoza, 50197, Spain, jbarnett@zlc.edu.es, Mozart Menezes, Jarrod Goentzel

Hydrogen has been identified as a clean alternative to store energy from volatile sources. We analyze the production and distribution network design problem of a firm generating electricity from wind and producing hydrogen by electrolysis, in the presence of stochastic energy prices and supply. We provide solution approaches using column generation, and use our model to evaluate a future hydrogen supply chain in Spain, under different distribution policies and government incentive schemes.

3 - R&D Portfolio Analysis of Low Carbon Energy Technologies for Climate Change Mitigation

Rose Zdybel, University of Massachusetts-Amherst, 120D Marston Hall, Amherst, MA, United States of America, rozoe@msn.com

We analyze R&D portfolios of low carbon advanced energy technologies for climate change mitigation. We use the GCAM integrated assessment model to analyze the effects of combinations of low carbon energy technologies on CO2 concentration stabilization costs and then combine the results with probabilistic data from expert elicitations. We also develop econometric relationships between variables to estimate results for input values other than those that are part of the elicitations.

4 - A Decision Support System for Managing Wind-turbines with Storage in Smart-grids

Frederic Murphy, Professor, Temple University, Alter Hall 435, Philadelphia, PA, 19122, United States of America, fmurphy@temple.edu, Fernando Oliviera

We analyze the wind-turbine business model given the opportunities created by the smart grid and by efficient electric battery storage systems. We model the interaction between dynamic prices and wind-regimes; we analyze how batteries can be used to improve wind-turbines reliability and profitability. We study how forward and option contracts can be used by a wind-turbine to hedge risk and we use conditional value at risk to assess the wind-turbine risk exposure and as a basis for risk-hedging.

■ SA21

21- West 212 A- CC

Applications of Networks and Graphs

Contributed Session

Chair: Zeynep Ertem, Texas A&M University, Industrial & Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States of America, zeynep84@tamu.edu

1 - Detecting Research Fronts using Citation Network Analysis

Katsuhide Fujita, The University of Tokyo, 2-11-16 Yayoi, Bunkyo-ku, Tokyo, 113-8656, Japan, fujita@ipr-ctr.t.u-tokyo.ac.jp, Yuya Kajikawa, Junichiro Mori, Ichiro Sakata

One of the important methodologies for detecting the research fronts is the citation network analysis. Especially, citation network analysis with combinational types or weights has possibilities of finding the new research fronts compared with non-weighted and single type of citation networks. We perform a comparative study to investigate the each type of citation networks in detecting a research front using visibility, speed, topological relevance and keyword similarity.

2 - Social Network Analysis at Wine and Food Festival

Bomi Kang, Associate Professor, Coastal Carolina University, P O Box 261954, Conway, SC, United States of America, bkang@coastal.edu, Young Jae Kim, Taylor Damonte

Social network analysis emphasizes the importance of constructing the interconnectedness among concepts and knowledge networks in respondents' minds. The technique has gained popular use in social science over the past three decades. Using concept maps and degree centralities derived from social network analysis, authors demonstrated new insights in festivals in Myrtle Beach Area, through this novel technique.

3 - Traffic Grooming in Optical Networks: Decomposition and Partial LP Relaxation

Hui Wang, PhD Candidate, North Carolina State University, 2152 Burlington Labs, Raleigh, NC, 27695, United States of America, hwang4@ncsu.edu, George Rouskas

We consider the traffic grooming problem, a fundamental network design problem in optical networks. We propose a new decomposition approach with two subproblems: (1) virtual topology and traffic routing (VTTR), and (2) routing and wavelength assignment (RWA). We also propose an ascending utilization iterative algorithm based on partial LP relaxation to further improve the scalability of VTTR. Our approach delivers a desirable tradeoff between running time and quality of the final solution.

4 - Graph Theoretical Analysis of Brain Networks

Zeynep Ertem, Texas A&M University,Industrial & Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States of America, zeynep84@tamu.edu, Sergiy Butenko

Exploring the connectivity patterns of human brain is gaining more interest in the last decade. Correlated low frequency fluctuations in the blood oxygenation level dependent signal have been widely observed in connected brain regions. Resting state functional magnetic resonance imaging (R-fMRI) consists of hundreds of time periods for thousands of image voxels. Our aim is to model the brain as a complex network. The clusters are identified with graph theoretical analysis.

■ SA22

22- West 212 B- CC

Topics in Real Time and Embedded Computing

Sponsor: Computing Society

Sponsored Session

Chair: Alex Mills, Indiana University Kelley School of Business, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, millsaf@indiana.edu

1 - Optimization-based Frameworks for Dynamic Configuration of Real-time Systems with Energy Constraints

Eduardo Camponogara, Professor, Federal University of Santa Catarina, Cx. P. 476, Florianopolis, 88040, Brazil, camponog@das.ufsc.br, Riad Nassiffe, George Lima

Embedded real-time systems powered by batteries require suitable support for energy-savings at the operating system level. Mechanisms to do so must take into consideration not only energy constraints but also schedulability since tasks must execute within predefined time windows. Further, it is desired that application quality of service (QoS) is optimized. This talk presents two optimization-based frameworks for maximizing application QoS subject to both schedulability and energy constraints.

2 - Can Randomness Buy Clairvoyance? Stochastic Scheduling of Mixed Criticality Real-time Job Systems

Bader Al-Ahmad, PhD Student, University of British Columbia, 2205 Lower Mall, P.O. Box 70, Vancouver, BC, V6T1Z4, Canada, baderalahmad84@gmail.com, Sathish Gopalakrishnan

We pose the problem of stochastically scheduling mixed criticality jobs when job execution time distributions at all criticality levels are given. By stochastic, the dynamical evolution of the system criticality level over time is captured by a stochastic process. We ask: is such information any beneficial in reducing the pessimism of current deterministic algorithms? Our objective is to match as closely the performance of a powerful oracle that knows the future system behavior realization.

3 - Temporal Logic Testing for Cyber-physical Systems

Georgios Fainekos, Arizona State University, 699 S. Mill Ave., Tempe, AZ, 85281, United States of America, Georgios.Fainekos@asu.edu, Sriram Sankaranarayanan

One of the major challenges in Model Based Development (MBD) of Cyber-Physical Systems (CPS) is the verification of real-time functional system properties. In general, the problem is undecidable due to the interplay between continuous and discrete system dynamics. In this talk, we present how the problem of verification can be posed as an optimization problem which can be solved using stochastic optimization techniques including Monte-Carlo methods and the Cross Entropy method.

■ SA23

23- West 212 C- CC

Survivable Networks

Sponsor: Telecommunications

Sponsored Session

Chair: Abdulah Konak, Pennsylvania State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, auk3@psu.edu

1 - Survivable Capacitated Layered Networks with Spanning Tree Protection

Tachun Lin, Cameron University, 2800 W Gore Blvd, Lawton, OK, 73505, United States of America, tlin@cameron.edu, Zhili Zhou, Krishnaiyan Thulasiraman

In this paper, we study the survivability problem in capacitated layered networks. We propose necessary and sufficient conditions for the existence of survivable routing with upper-layer protection, formulate this problem as a mixed-integer program, and design a novel upper-layer spanning tree protection algorithm which guarantees the upper-layer network connectivity and generates routings within lower-layer capacity. Computational experiments demonstrate the efficiency of our algorithm.

2 - Resilience: A New Metric to Evaluate Network Reliability/Survivability

Ozgur Kabadurmus, Auburn University, 3333 Shelby Center, Auburn, AL, 36849, United States of America, ozk0001@tigermail.auburn.edu, Alice E. Smith

In telecommunication network design problems, survivability and reliability are used to evaluate quality of service. In this study, a new metric that combines network reliability with network resilience is presented to measure reliability/survivability more effectively. It is compared with well-known network reliability/survivability metrics, namely k-connectivity and two terminal reliability, and its benefits and computational efficiency are discussed.

3 - Lexicographical Minimization of Routing Hops in Hop-constrained Node Survivable Networks

Luis Eduardo Neves Gouveia, CIO and DEIO, Cidade Universiteria, Bloco C6, Campo Grande, Lisbon, 1749-016, Portugal, legouveia@fc.ul.pt, Pedro Patricio, Amaro de Sousa

We address the following traffic engineering problem: how to route deterministic changes of original demands in a pre-dimensioned network, maintaining network survivability and QoS, while minimizing the number of hops of either i) all service paths or ii) the worst service path for each commodity, in a lexicographical sense. We present and discuss two classes of Integer Linear Programming models for this problem and computational results considering several traffic demand settings.

4 - A Network Support System for Ad-hoc Networks using Autonomous Intelligence Agents

Abdulah Konak, Pennsylvania State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, auk3@psu.edu

This paper presents a decentralized approach to maintain the connectivity of a MANET using autonomous, intelligent agents. Concepts from the social network analysis along with flocking algorithms are utilized to maintain the connectivity of mobile nodes. Computational results are presented to demonstrate the effect of various local agent behaviors on the global network connectivity.

■ SA24

24- West 213 A- CC

Advances in Modeling and Optimal Control of Infectious Disease Spread

Sponsor: Health Applications Society

Sponsored Session

Chair: Reza Yaesoubi, Post-Doctoral Research Fellow, Harvard Medical School, 641 Huntington Ave., Boston, MA, 02115, United States of America, reza.yaesoubi@gmail.com

1 - A Model for Optimal Allocation of HIV Prevention and Treatment Funds

Margaret Brandeau, Stanford University, Huang Engineering Center, Stanford, CA, 94305, United States of America, brandeau@stanford.edu, Sabina Alistar, Elisa Long, Eduard Beck

We develop a model to determine the optimal allocation of resources between HIV prevention and treatment services to minimize the basic reproduction number. Our model includes multiple populations with different transmission modes, as well as production functions that relate investment in prevention and treatment to changes in transmission and treatment rates. We apply our model to examine HIV epidemic control in two different settings, Uganda and Russia.

2 - Evaluating the Effectiveness of Interventions During an Influenza Pandemic

Anna Teytelman, PhD Student, Massachusetts Institute of Technology, Operations Research Center, Cambridge, MA, 02139, United States of America, teytanna@mit.edu, Richard Larson

With pandemic influenza, pharmaceutical and non-pharmaceutical resources are limited. We present dynamic, multi-regional, vaccine allocation schemes for the USA. For single communities with heterogeneous populations, we examine the effects of timing and targeting strategies on reaching herd immunity. We conclude with strategies for combining vaccines with non-pharmaceutical interventions such as hand-washing, public awareness campaigns and school closures to decrease intensity of an outbreak.

3 - Resource Allocation for Optimal Control of Epidemics: Can Treatment Compete?

Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, 94309, United States of America, ssabina@stanford.edu

Controlling infectious diseases such of HIV requires judicious resource allocation between treatment and prevention. We use an optimal control approach to determine how the allocation decision will change over time, as an epidemic evolves. Our model considers several epidemiological objectives relevant in practice, and non-linear epidemic dynamics. We characterize the optimal solution, identify conditions for optimality, and provide numerical examples.

4 - A Framework for Real-time Decision Making During Epidemics

Reza Yaesoubi, Post-Doctoral Research Fellow, Harvard Medical School, 641 Huntington Ave., Boston, MA, 02115, United States of America, reza.yaesoubi@gmail.com, Ted Cohen

We propose a novel framework for optimizing decisions during infectious disease epidemics based on real-time observations from the epidemic and resource availability. The framework is flexible and can incorporate diseases of varying natural history and a broad range of interventions. Using influenza and tuberculosis as examples, we demonstrate how the framework can be used to inform decisions to optimize population health within constraints imposed by resource availability.

■ SA25

25- West 213 B- CC

Optimization Methods in Radiation Therapy

Sponsor: Health Applications Society

Sponsored Session

Chair: Timothy Chan, Assistant Professor, University of Toronto, 5 King's College Rd, Toronto, Canada, tcychan@mie.utoronto.ca

1 - Imaging Based Treatment Plan Optimization for Glioblastoma

Jan Unkelbach, Massachusetts General Hospital, 30 Fruit Street, Boston, MA, United States of America, junkelbach@partners.org, Bjoern Menze, Ender Konukoglu, Helen Shih

Treatment planning for radiotherapy consists of two problems: 1) determining external beam parameters to realize a desired dose distribution, and 2) determining the desired dose distribution from clinical and biological data including dose-response relations, imaging data, or histology. Quantitative approaches to integrate these sources of data involve both mathematical modeling approaches a well as statistical machine learning methods. This approach is discussed for treatments of gliomas.

2 - Spatiotemporally Adaptive Radiotherapy for Hypoxic Tumors

Fatemeh Saberian, University of Washington, Seattle, WA, United States of America, saberian@uw.edu, Archis Ghate

Lack of oxygen (hypoxia) decreases tumor radiosensitivity and hence can reduce treatment efficacy. We present a stochastic control approach to design treatment plans that adapt to spatiotemporal variations in hypoxia.

3 - Beam Orientation Optimization in Radiation Therapy Treatment Planning

Troy Long, Student, University of Michigan, 1205 Beal Ave., Room 1791, Ann Arbor, MI, 48109, United States of America, troylong@umich.edu, Edwin Romeijn

Beam orientation optimization selects stationary beam positions to produce a both high quality and efficiently deliverable treatment plan, resulting in a large-scale combinatorial optimization problem. We study an efficient method for selecting beam orientations for IMRT treatments that explicitly incorporates the quality of the resulting optimal dose distribution.

4 - Optimal Magnetic Sweeping Design for Metastatic Cancer Tumor Treatment

So Yeon Chun, Assistant Professor, Georgetown University, McDonough School of Business, 37th and O Streets, Washington DC, 20057, United States of America, sc1286@georgetown.edu, Alek Nacev

Metastatic cancer is cancer that has spread from the place where it first started to another place in the body. Patients with metastatic cancer have thousands of tumors spread throughout their body and it is recognized that many of these tumors are poorly vascularized compared to normal tissues. To improve poor chemotherapeutic efficacy in metastases, we control magnets to sweep chemotherapy. We analyze autopsy data of thousands of tumors and optimize magnetic pulling treatment parameters.

■ SA26

26- North 221 A- CC

Inventory Models and Forecast Updating

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Gad Allon, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

1 - Is More Inventory Information Better? Impact of Downstream Data on Upstream Supply Forecast Accuracy

Ruomeng Cui, PhD Student, Northwestern University, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, r-cui@kellogg.northwestern.edu, Jan Van Mieghem, Gad Allon, Achal Bassamboo

We investigate the improvement of forecast accuracy of the upstream supplier's shipment by using downstream retailer data for a beverage drink company.

2 - Emergency Inventory Pooling

Jordan Tong, Assistant Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States of America, jtong@bus.wisc.edu, Jing-Sheng Song, Fang Liu

Organizations contract with vendors to always maintain a minimum level of inventory for disaster preparedness. We consider the problem of how to manage this emergency inventory among multiple vendors. Instead of stockpiling, we show that a type of virtual pooling we call emergency inventory pooling can reduce costs. We identify the optimal policy and derive an algorithm for implementation. Finally, we examine for which firms and products emergency inventory pooling is most valuable.

3 - Multi-item Closed-loop Inventory Control with Forecast Updates: A Model for DVD-by-Mail Services

Li Chen, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, li.chen@duke.edu, Safak Yucel, Kaijie Zhu

In this paper, we present a multi-item forecasting-inventory model for a DVD-by-mail service provider (such as Netflix). Our inventory model features a two-sided fixed cost for each item and a multi-item service constraint. We propose an innovative forecasting algorithm and an effective heuristic for this problem. Simulation studies show that a significant performance improvement is achieved by the new forecasting algorithm and the multi-item optimization heuristic.

■ SA27

27- North 221 B- CC

Information Economics and Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Wenqiang Xiao, Assistant Professor, New York University, 44 W 4 Street, KMC 8-72, New York, NY, 10012, United States of America, wxiao@stern.nyu.edu

1 - Efficient Supplier or Responsive Supplier? Analysis of Sourcing Strategies under Competition

Fuqiang Zhang, Olin Business School, Washington University, St. Louis, MO, United States of America, Fzhang22@wustl.edu, Xiaole Wu

Motivated by the recent trend of backshoring, this paper studies a sourcing game where competing firms may choose between efficient sourcing (e.g., sourcing from an international supplier) and responsive sourcing (e.g., sourcing from a domestic supplier). By characterizing the equilibrium outcome, we find some interesting results driven by the information structure of the sourcing game.

2 - Signaling to Partially Informed Investors in the Newsvendor Model

William Schmidt, Harvard Business School, Wyss House, Boston, MA, 02163, United States of America, wschmidt@hbs.edu, Vishal Gaur, Ananth Raman, Richard Lai

We investigate the effect of short-term objectives and incomplete information on a firm's operational decisions. We incorporate the newsvendor model using discrete stocking quantities into a signaling game and identify the circumstances under which the firm's choice of stocking quantity purposefully does not maximize expected profits. Our model provides analytical support for the abundant anecdotal evidence that superior firms will knowingly under-invest in capacity under certain circumstances.

3 - Stocking More versus Less: The Roles of Demand Volatility and Profit Margin under Market Valuation

Wenqiang Xiao, Assistant Professor, New York University, 44 W 4 Street, KMC 8-72, New York, NY, 10012, United States of America, wxiao@stern.nyu.edu, Guoming Lai

We study the effects of asymmetric information of demand volatility on the inventory decision of a public firm who cares about not only its operational profits but also its market value. We find that the firm, when it faces a high demand volatility (less efficient), overstocks if the profit margin is low and understocks if the profit margin is high, while the firm with a low demand volatility (more efficient) may either overstock or understock in both cases.

■ SA28

28- North 221 C- CC

Managing Manufacturing and Related Services

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Opher Baron, University of Toronto, 105 St George Street, Toronto, ON, Canada, Opher.Baron@rotman.utoronto.ca

Co-Chair: Philipp Afeche, Rotman School of Management, University of Toronto, 105 St.George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca

1 - Reverse Logistics and Warranty Matching in a Large Consumer Electronic Retailer

Andre Calmon, Massachusetts Institue of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, acalmon@mit.edu, Stephen Graves

We describe, model and optimize the reverse logistics of our industrial partner, a Fortune 500 company that sells consumer electronics. Based on real data, we introduce a discrete-time model that captures the dynamics of this reverse logistics system. In addition, using an approximate dynamic programming approach, we propose a closed-loop data-driven policy for managing inventory. The performance of this policy is analysed theoretically and through numerical experiments.

2 - The Assortment Packing Problem: Multiperiod Assortment Planning for Short-Lived Products

Victor Martinez de Albeniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Felipe Caro, Paat Rusmevichientong

Retailers introduce new items to refresh product lines and maintain their market share. We study how a firm must decide, in advance, the release date of each product in a given collection over a selling season. Our formulation models the trade-offs among profit margins, preference weights, and limited life cycles. A key aspect of the problem is that each product is short-lived in the sense that, once introduced, its attractiveness lasts only a few periods and vanishes over time.

3 - The Economics of Joint Production in Services

Guillaume Roels, Assistant Professor, UCLA, 110 Westwood Plaza, Los Angeles, 90095, United States of America, guillaume.roels@anderson.ucla.edu

In this talk, we propose a classification of services based on the degree of complementarity or substitutability between the provider's and the client's efforts. We study how efforts change when they become more complementary and when their distribution shifts from the service provider to the client. We identify non-monotone effects of these changes, revealing a trade-off between operational efficiency, leading to more specialization, and complementarity, pushing for greater effort alignment.

4 - Understanding the Performance of the Long Chain and Sparse Designs in Process Flexibility

Yehua Wei, Massachusetts Institute of Technology, 60 Wadsworth,10B, Cambridge, MA, 02142, United States of America, y4wei@mit.edu, David Simchi-Levi

This presentation develops theories to explain the effectiveness of the long chain and other sparse process flexibility designs in manufacturing systems. In the presentation, we first uncover a supermodular property for the long chain, and proceed to prove several theorems. Our results verify the effectiveness of the long chain, which has been observed empirically in both academia and industry. Moreover, the results provide new insights to how to create sparse designs.

■ SA29

29- North 222 A- CC

Workforce Management in the Services

Cluster: Workforce Management

Invited Session

Chair: Jennifer Ryan, Associate Professor, RPI, 110 8th Street, CII, Troy, NY, 12180, United States of America, ryanj6@rpi.edu

1 - Planning for the Future - A Model of Cardiac Surgeons in Canada

Sonia Vanderby, Assistant Professor, University of Saskatchewan, 57 Campus Drive, Saskatoon, SK, S7N 5A9, Canada, sonia.vanderby@usask.ca, Michael Carter

We present a model simulating the workforce within a single specialty at a national level which includes students training to enter the profession, providing a tool that would help to inform future resource planning. This presentation includes details of the model, developed using system dynamics modeling, and a demonstration of it using the example of cardiac surgeons in Canada, and analyzes the effect of provider motivations on system outcomes.

2 - Demand Management for Optimal Workforce Planning in Professional Service Firms

Vincent Hargaden, University College Dublin, School of Mech & Materials Eng, Belfield, Dublin 4, Ireland, vincent.hargaden@ucd.ie, Amir Azaron, Jennifer Ryan

Our previous work has focused on characterizing and modeling the workforce planning process in professional service firms. In this, we initially assumed customer projects, i.e., demand, have fixed start dates. However, this can lead to firms not being able to fulfil all demand due to insufficient supply of workers/skills at certain points in time. We now extend our model to allow firms better manage their demand and worker/skill availability by identifying the optimum set of project start dates.

3 - Dynamics of Labor, Traffic, and Sales in Retail Stores

Howard Hao-Chun Chuang, PhD Candidate, Mays Business School at Texas A&M University, College Station, TX, 77843-4217, United States of America, hchuang@mays.tamu.edu, Olga Perdikaki, Rogelio Oliva

We perform an empirical study that comprises multiple modeling efforts. First, we develop a response function to quantify the impact of labor and traffic on sales. Second, we propose and econometrically estimate a generic staffing heuristic. Last, we conduct counterfactual analysis in which the heuristic performs closely to the idealized optimal and outperforms existing staffing levels. Our major contribution is to quantify the benefits of planning labor based on sales as well as traffic.

4 - Maintenance Policies for Multiple Machines with Technician Constraints in a Stochastic Environment

Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este #19A -40, Bogota, 1111, Colombia, r.akhavan@uniandes.edu.co, Juan Sebastian Borrero Angarita

We consider the problem of dynamic allocation of technicians to perform preventive maintenance (PM) operations on degrading machines in order to minimize the expected PM, repair, and waiting work in process costs. We assume Markovian processes for the degradation and load, stochastic lengths for the PM and repair operations and that each technician is able to serve only a particular set of machines. Near-optimal policies are obtained using approximate dynamic programming techniques.

■ SA30

30- North 222 B- CC

Operational and Financial Decisions of the Firm

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Jiri Chod, Boston College, 140 Commonwealth Ave, Chestnut Hill, United States of America, jiri.chod@bc.edu

1 - Inventory Financing and Trade Credit

Qi Wu, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, 78703, United States of America, qi.wu@phd.mccombs.utexas.edu, Kumar Muthuraman, Sridhar Seshari

Trade credit is one of the common ways to finance inventory and is often offered via an early payment discount. In this talk, we present a model of trade credit, embedded in a stochastic inventory control problem. We compute the optimal joint inventory, cash management and trade credit decisions, based on which, we show that trade credit helps with smoothing cash flows and making better operational decisions.

2 - The Impact of Budget Constraints on Flexible versus Dedicated Technology Choice

Onur Boyabatli, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg, Tiecheng Leng, Beril Toktay

This paper analyzes the impact of financial constraints in a capacity investment setting. We model a two-product firm that decides on its technology choice (flexible versus dedicated) and capacity level under demand uncertainty, and the production quantities after this uncertainty is resolved. Differing from the majority of the stochastic capacity investment literature, we assume that the firm is budget-constrained both in the capacity investment and production stages.

3 - The Provision and Impact of Trade Credit in Imbalanced Supply Chains: An Empirical Study

Jianer Zhou, Assistant Professor, Boston College, Fulton Hall 454C, 140 Commonwealth Ave., Chestnut Hill, MA, 02467, United States of America, jianer.zhou@bc.edu, Hsiao-Hui Lee

Using a large dataset that links non-service U.S. suppliers with their major customers, we show trade credit to be a collaborative and competitive tool in supply chains. While suppliers with smaller market share extend more trade credit to be competitive, suppliers with weaker bargaining power extend less to mitigate financing risk. When offered at the industry-average level, trade credit increases suppliers' sales, but when offered more aggressively, it reduces the entire supply chain sales.

4 - Startegic Consumer Impact on Bankruptcy and Competition

John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu, Rodney Parker, Song Alex Yang

In a previous model of firm competition under the threat of one firm's bankruptcy, we showed how that firm could use bankruptcy strategically to gain concessions from a dominant supplier. In this work, we consider the effect on the supply chain from consumers who anticipate future price discounts in the event of a bankruptcy.

■ SA31

31- North 222 C- CC

Supply Chain Modeling under Uncertainty

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Joseph Geunes, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, geunes@ise.ufl.edu

1 - A Capacitated Supplier Prioritizing Asymmetric Retailers

Zohar Strinka, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, zstrinka@umich.edu, Edwin Romeijn, Christopher Tang

We consider a capacitated supplier and a set of asymmetric retailers. The retailers are assumed to have complete information, face newsvendor-type costs due to uncertain demand, and have a common exogenous selling price. The supplier solicits bids of a per-unit price and order quantity from each retailer, and then allocates the fixed capacity based on those bids. We show structural properties of equilibrium solutions for two retailers when the highest bid receives highest priority.

2 - Planning Product Availability for an Assortment of Vertically Differentiated Products

Yalcin Akcay, Koc University, Rumelifeneri Yolu, Istanbul, Turkey, yakcay@ku.edu.tr, Hari Natarajan

In many industries, firms offer a variety of substitutable products that customers can choose from. Because product demands are inter-related, managers must determine inventory policies jointly. Considering the case of a vertically-differentiated product assortment, we model and analyze the problem of determining the optimal inventory policy for a product assortment.

3 - Dynamic Pricing with Strategic Customers under Price Adjustment Policy

Boxiao (Beryl) Chen, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, boxchen@umich.edu, Xiuli Chao, Hyun-Soo Ahn

We study the dynamic pricing strategy of a monopolist serving heterogeneous forward-looking customers. The firm offers a price adjustment policy, which guarantees current buyers a full refund of the difference if they find a lower future price within a certain time window. We establish the existence of a subgame perfect equilibrium pricing policy and show that the firm sets different equilibrium pricing patterns in different regions of system parameters.

4 - Assortment Planning in Multiple Selling Channels

Yiqiang Su, Phd Candidate, University of Florida, Department of Industrial and Systems Eng, 450 Weil Hall, Gainesville, FL, 32607, United States of America, ysu1987@ufl.edu, Joseph Geunes

In this research, we consider a clicks-and-mortar retailer who sells goods to end-customers through both physical and virtual (e-commerce) channels. The retailer has limited capacity, and would like to determine the set of products to offer, both in the local and online stores to maximize its profit from sales during a single selling season. MNL and Exogenous demand models are used to capture the customer choice behaviors, and a chance-constrained two stage model is built to solve this problem.

■ SA32

32- North 223- CC

Quality Control and Learning in Manufacturing

Contributed Session

Chair: Gabriel Burnett, The Boeing Company, P.O. Box 3707, MC 13-98, Seattle, WA, 98124, United States of America, gabriel.a.burnett@boeing.com

1 - Changing the Paradigm for Education in Quality

Thong Goh, Professor, National University of Singapore, 1 Engineering Dr 2, Blk E1A #06-25, Singapore, 117576, Singapore, isegohtn@nus.edu.sg

Quality education has been "customer oriented" for many decades. Some ideas and techniques have become outmoded in the modern society. It is time that some paradigm shift was made in quality management education. This needs to be realized soon if the new generation of quality practioners are to find themselves relevant.

2 - A Hybrid Inspection Strategy for Rapid Deployment of Automated Inspection Technology

Patrick Spicer, General Motors, General Motors R&D Center, Warren, MI, 48093, United States of America, patrick.spicer@gm.com, Mike Wincek, Jeffrey Abell, Hui Wang

New manufacturing processes for advanced automotive propulsion systems (i.e. batteries or fuel cells) may not have well-developed automated inspection technologies at first. In this presentation, a hybrid inspection strategy is described that enables a manufacturer to begin with human inspection and gradually phase-in automated inspection technology until the inspection task is completely automated. This strategy has been successfully implemented in an automotive assembly plant.

3 - Continuous Improvement in Cellular Manufacturing: The Case of an Electronics Manufacturer in Japan

Tomoaki Shimada, Associate Professor of Operations Management, Kobe University, 2-1 Rokkodai-cho, Nada-ku, Kobe, 657-8501, Japan, shimada@b.kobe-u.ac.jp, James Ang, Hisashi Kurata

This study is case-based research that analyzes continuous improvement in cellular manufacturing at an IC recorder manufacturing plant in Japan. The study provides practical insight into how to make an effort to improve the productivity of one-worker cellular production over time. The implementation results indicate that workers reduced the takt time by about 19%, and confirm that continuous improvement plays an important role in cellular manufacturing from the perspective of human dimensions.

4 - Investigation of Learning Curves in Production Systems

Gabriel Burnett, The Boeing Company, P.O. Box 3707, MC 13-98, Seattle, WA, 98124, United States of America, gabriel.a.burnett@boeing.com, Adam Graunke

We investigate the behavior of learning curves in the context of large scale production systems. Learning curves are used extensively when planning production systems. We demonstrate the implications of a variety of commonly held assumptions. We then provide an empirical study to analyze which events (i.e. rate breaks, technology insertion, derivative products, etc) create a significant departure from the global learning curve and how such events could be modeled in the future.

■ SA33

33- North 224 A- CC

Sustainable and Responsible Operations

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations

Sponsored Session

Chair: Jose Cruz, Associate Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States of America, jose.cruz@business.uconn.edu

1 - Closed-loop Supply Chain with Quality Differentiation

Patrick Qiang, Assistant Professor, Pennsylvania State University, Great Valley, Philadelphia, PA, United States of America, qzq10@gv.psu.edu

We model the CLSC that captures consumer's heterogeneous valuation on the remanufactured product and the new product. The model captures the interaction among various players, including manufacturers, retailers, and consumers. Numerical examples are used to provide managerial implications.

2 - A Dynamic Model to Study Sustainable Business Policies in a Closed Loop Supply Chain

Sudip Bhattacharjee, Associate Professor, University of Connecticut, Storrs, CT, United States of America, sbhattacharjee@business.uconn.edu, Jose Cruz

The sustainability of a closed loop supply chain depends on the economic viability of all actors in the chain. We model the phenomenon analytically and create dynamic models to study key factors that impact profitability of partners in the chain. We find that product design, marketing and related actions of up-market producers significantly influence the ability of down-market recyclers to survive. We discuss environmental and revenue implications of several policy scenarios.

3 - Operationalizing Sustainable Production Strategies Subject to Diminishing Resources

Manuel Nunez, Associate Professor, School of Business, UConn, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, mnunez@business.uconn.edu, Hsiao-Hui Lee

We develop a two-stage dynamic model to analyze different sustainability strategic decisions such as starting a recycling program or developing alternative technologies to replace a diminishing resource. We investigate the impact of the parameters on the optimal decision and discuss how to operationalize the decisions in the supply chain.

4 - Mitigating Global Supply Chain Risks through Corporate Social Responsibility

Jose Cruz, Associate Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States of America, jose.cruz@business.uconn.edu

We develop a decision model that captures supply side disruption risks, social risks, and demand side uncertainty within an integrated global supply chain and corporate social responsibility (CSR) modeling and analysis framework. We investigate the effects of CSR activities in a global supply chain and compute the equilibrium product flows, prices, and levels of social responsibility activities. The results show that CSR activities can potentially be used to mitigate global supply chain risk.

■ SA34

34- North 224 B-CC

Decisions in Product Development I

Contributed Session

Chair: Amir Sanayei, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, sanayei@wayne.edu

1 - Decision Bias in Search for the Best Design Alternative
Gulru Ozkan, Assistant Professor, Clemson University, 101 Sirrine Hall, Clemson, SC, 29678, United States of America, gulruo@clemson.edu, David Hall, Jeremy Hutchison-Krupat, Fred Switzer

In new product development, one key question is in which order to evaluate design alternatives and when to stop testing and iteration to develop a specific alternative further (search for the best alternative). Existing models analytically develop optimal search strategies for the managers while manager's search behavior may deviate from these. Drawing from psychological literature in judgment and decision-making, such as the prospect theory, we analyze the manager's decision making strategy.

2 - Construction of a UX Component Model and its Application: A Case Study on Smart Phones
Jun-yeon Heo, Pohang University of Science and Technology, Eng-Building 4-316, Hyoja-dong, Nam-gu, Pohang, Gyugbuk, Korea, Republic of, bluejy@postech.ac.kr, Min Jun Kim, Hyun-Jin Kim, Seungchul Shin, Hyo-in Ahn, Kwang-Jae Kim, Jinho Yim

As the notion of User eXperience (UX) plays an important role in enhancing the competitiveness of products, UX evaluation has become an important issue in new product development. This talk presents a repository of UX components, called a UX component model, which is used for evaluating the UX of products. An application of the model is also presented using a case study on smart phones.

3 - An Optimization of the Specification of BTO Technology System
Yuji Sato, Mie Chukyo University, 1846 Kubo, Matsusaka, 515-8511, Japan, ysatoh@1988.jukuin.keio.ac.jp

The objectives of this study were to develop a diagnosis procedure of user's preference for a new BTO technology system, and to subsequently optimize the specification of the system. Determining the specification of a new system is complicated task, because of subjective factors entering into the evaluation of necessary and sufficient specification. By combining cost-benefit analysis and AHP, this issue was addressed. A case study was carried out to demonstrate the applicability of our approach.

4 - Technology Selection: Performance, Cost and Time Considerations during Product Life Cycle
Amir Sanayei, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, sanayei@wayne.edu, Leslie Monplaisir

Technology selection is one of the most important and strategic decisions made in new product development process. We developed a mathematical modeling framework to select the best alternative technology in order to analyze the implications of time to market, performance and development cost. The model considers whole product life cycle in a competitive environment. It also determines optimal product launch time and the best managerial actions in order to maximize total profit.

■ SA35

35- North 225 A- CC

Sustainability and Energy Cost

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Parijat Dube, IBM, TJ Watson Research Center, Hawthorne, NY, United States of America, pdube@us.ibm.com

Co-Chair: Genady Ya. Grabarnik, St. John's University, Queens, NY, United States of America, grabarng@stjohns.edu

1 - The Carbon Reduction Effect and Policy Choices of Adjusting Industrial Structure
Zengkai Zhang, School of Management, Xiían Jiaotong University, No.28, Xianning West Road, Shaanxi, Xi'an, China, zengkaizhang@sina.com, Ju'e Guo

Reducing carbon emissions and adjusting industrial structure are China's two strategic tasks, while adjusting industrial structure is the essential way of carbon reduction. Based on China's SAM of 2007, this paper develops China's dynamic CGE model to evaluate the contribution of the industrial structure adjustment in carbon reduction, and proposes policy recommendations on adjusting industrial structure.

2 - Medical Imaging Capacity and its Impacts on Energy and Sustainability
Janet Twomey, Professor, Wichita State University, Industrial and Manufacturing Engineering, 1845 Fairmount St, Wichita, KS, 67206, United States of America, janet.twomey@wichita.edu

The research presented here highlights a new area for energy improvement in healthcare – the energy and material use link to patient outcome decisions and alternatives.The outcomes of a study investigating the impact of medical imaging capacity decisions on energy and sustainability will be presented for a medical center and the nation's healthcare system. Research sponsored by: NSF CMMI 1037961 and NSF CMMI 0946342.

3 - SUITS: A Framework for Sustainable IT Services
Parijat Dube, IBM, TJ Watson Research Center, Hawthorne, NY, United States of America, pdube@us.ibm.com, Genady Ya. Grabarnik, Laura Shwartz

We introduce the Sustainable IT Services (SUITS) framework to develop models for operational performance of an IT Service Provider in a global environment with carbon taxation and carbon credit trading markets. The models are used to formulate a revenue optimization problem for the IT Service Provider in this environment. The model solutions can provide guidance for designing operational level of different IT components and for creating effective strategies for trading in carbon markets.

■ SA36

36- North 225 B- CC

New Applications of Pricing

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@MIT.EDU

1 - Designing Subsidies with Industry Response Dynamics: Commitment vs. Flexibility
Ruben Lobel, Assistant Professor, Wharton School, Philadelphia, United States of America, rlobel@wharton.upenn.edu, Georgia Perakis, Maxime Cohen

Governments use consumer incentives to promote new technologies and stimulate investments from the private sector (eg. solar panels). We model the interaction between a government and an industry player in a multi-period setting under uncertain demand. We show how the timing of decisions will affect production and subsidy levels. In particular, a flexible subsidy policy will be on average more expensive for the government than a committed long-term policy.

2 - Revenue Management of Reusable Resources with Advanced Reservations
Cong Shi, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambirdge, MA, 02139, United States of America, shicong@mit.edu, Retsef Levi

This paper studies a class of revenue management problems in systems with reusable resources and advanced reservations. A simple control policy called the class selection policy (CSP) is proposed based on solving a knapsack-type linear program (LP). It is shown that the CSP and its variants perform provably near-optimal in the Halfin-Whitt regimes. The analysis is based on new approaches that model the problem as loss network systems with advanced reservations.

3 - A Simultaneous Approximation for Many Choice Models
Vineet Goyal, Columbia University, 500W 120th St., New York, NY, United States of America, vgoyal@ieor.columbia.edu, Jose Blanchet, Guillermo Gallego

Modeling customer choice probabilities is a critical problem in assortment optimization problems. Several parametric models including MNL, Nested Logit, and Mixture of MNL are widely used in practice but the selection of optimal model is not usually clear. We present a non-parametric choice model that is a simultaneous approximation for a large class of choice models. Furthermore, we give a polynomial time algorithm to compute an optimal assortment under this choice model.

4 - Demand-response in the Smart Grid: A Data-driven Pricing and Inventory Optimization Approach
Pavithra Harsha, Research Staff Member, IBM Research, 1101 Kitchawan Rd, 34-225, Yorktown Heights, NY, 10598, United States of America, pharsha@us.ibm.com, Dharmashankar Subramanian, Ramesh Natarajan

Demand response schemes based on dynamic pricing are of considerable interest in the emerging smart grid. We formulate the demand management problem as a price-sensitive newsvendor and present a novel data-driven, distribution-free approach that is based on the use of quantile and mixed quantile regression to jointly estimate the optimal generation level and pricing signals in the presence of multiple drivers of demand. We illustrate the efficacy, robustness and accuracy over alternate methods.

■ SA37

37- North 226 A- CC

Revenue Management and Pricing in Practice

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Tugrul Sanli, Director, R&D, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27513, United States of America, Tugrul.Sanli@sas.com

1 - Randomized Linear Programming Approach to Revenue Management

Vijay Desai, Opertations Research Specialist, SAS Institute Inc., SAS Campus Dr, Cary, NC, 27513, United States of America, VijayV.Desai@sas.com, Altan Gulcu

We provide a high-level overview of our approach to RM using RLP. Following are the key features of our methodology: a) Pricing of price-dependent products. b) Handles network-level overbooking as opposed to resource-level overbooking typically found in practice. c) Allows for imposition of service level constraints. d) Computes ancillary outputs such as occupancy forecast, revenue forecast and service levels, which are useful metrics for a revenue manager.

2 - Dynamic Pricing and Revenue Management

Maarten Oosten, SAS Institute, World Headquarters, SAS Campus Drive, Cary, NC, 27513, United States of America, maarten.oosten@sas.com

New technologies allow for pricies to be changed continuously, and optimal dynamic pricing algorithms take this freedom explicitly into account. In this presentation we explore several directions in which this can be taken.

3 - Estimation of Nested Logit Models using Data from a Single Firm

Jeff Newman, Research Engineer, Georgia Institute of Technology, 790 Atlantic Drive, Civil Engineering, Atlanta, GA, 30332, United States of America, jeff@newman.me, Laurie Garrow, Mark Ferguson

We examine identification issues for estimating parameters for discrete choice models with censored data. Most work in revenue management using such models has been focused on simple multinomial logit models, because the unique IIA property of this model makes estimating and applying parameters convenient. However, IIA is not usually consistent with actual choice behaviors. We examine the benefits and drawbacks of employing a nested logit model, which does not exhibit IIA.

4 - Improving the Forecasting Accuracy of Hotel Arrivals: A New Non-homogeneous Poisson Approach

Misuk Lee, IHG, 3 Ravinia Drive, Atlanta, GA, 30327, United States of America, Misuk.Lee@ihg.com

Demand forecast is one of key components of hotel revenue management. This study develops a new non-homogenous Poisson process approach to short-term demand forecast. By considering seasonality and heterogeneous booking curve patterns, we find better estimates for demand processes and thus improve forecasting accuracy. We present validation results on IHG hotel data along with a comparison to other benchmark models.

■ SA38

38- North 226 B- CC

Impact of Customer Behavior on Service

Sponsor: Service Science

Sponsored Session

Chair: Margaret Pierson, Assistant Professor, Tuck at Dartmouth, Hanover, NH, United States of America, mpierson@hbs.edu

1 - How Do Customers Respond to Service Quality Competition?

Ryan Buell, Assistant Professor, Harvard Business School, Morgan Hall T37, Boston, MA, 02163, United States of America, rbuell@hbs.edu, Dennis Campbell, Frances Frei

When does increased service quality competition lead to customer defection, and which customers are most likely to defect? We find that customers defect at a higher rate from the incumbent following increased service quality (price) competition when the incumbent offers high (low) quality service relative to existing competitors in a local market. We further show that it is the high quality incumbent's most profitable customers who are the most attracted by superior quality entrants.

2 - Modeling Customer Behavior in Multichannel Customer Support Services: An Information Stock Approach

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Kinshuk Jerath, Anuj Kumar

We analyze multichannel customer support environment of a health insurance firm in the US. We build a structural probability model to understand the customers' query arrival and channel choice processes. Our estimates suggest the telephone channel in our setting on average provides 20 times more information than the Web channel and that the Web on average provides information need instead of information gain – Web in our setting seems to confuse customers.

3 - Customer Response to Short-Term Price Fluctuations

Margaret Pierson, Assistant Professor, Tuck at Dartmouth, Hanover, NH, United States of America, mpierson@hbs.edu

Transactions at 15 gasoline stations in Massachusetts over two years are used to estimate consumer elasticity with respect to price on a transaction basis. A significant proportion of the observed transactions display high sensitivity to price. This customer behavior results in congestion at pumps during high prices, a counterintuitive result which constrains stations' price choices in practice.

■ SA39

39- North 226 C- CC

Service Scripting and Value Co-Creation

Sponsor: Service Science

Sponsored Session

Chair: Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu

1 - Scripting and Improvisation in Service Environments

Enrico Secchi, University of Victoria, Peter B. Gustavson School of Business, Business & Economics Building Room 254, Victoria, BC, V8P 5C2, Canada, esecchi@clemson.edu, Rohit Verma, Aleda Roth

Using the insights of the research on scripting and organizational improvisation, we develop an econometric model of the impact of different degrees of scripting and improvisation on services financial outcomes. We test our model using survey data and self reported financial performance from the hospitality industry.

2 - Co-Creation of Value for IT-Enabled Services: A Case of Geocaching

Tuure Tuunanen, University of Oulu, Department of Information Processing Science, P.O. 3000, 90014 University of Oulu, Finland, tuure@tuunanen.fi, Tero Vartiainen

This study uses laddering interviews to explore how value is co-created for IT-enabled services, more precisely geocaching. The results reveal that geocaching is distinctly hedonic in nature. The results also demonstrate how the consumer information systems framework can be applied for understanding which factors influence value co-creation for IT-enabled services.

3 - Analysis of Role of Service Variety and Real Options in Resort Timeshare Service Value

Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu

Although a major class of hospitality/travel experience service, little empirical research has examined timeshares or other fractional hospitality services. This paper examines whether service variety, in terms of breadth of vacation service experiences, or real options more strongly affect the perceived quality, valuation, and ownership of resort hotel timeshare services. We analyze hypotheses using both cross-sectional and longitudinal data sets.

■ SA40

40- North 227 A- CC

Dynamic Models for Sustainable Energy Policy Analysis

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Pedro Linares, Comillas P. University, Alberto Aguilera 25, Madrid, 28015, Spain, pedro.linares@upcomillas.es

1 - Canadian Energy Supply and Demand with ENERGY 2020: Scenarios and Sensitivity Cases
Matthew Hansen, Market Analyst, National Energy Board, 444-7th Ave., SW, Calgary, AB, T3C 0T1, Canada, Matthew.Hansen@neb-one.gc.ca

The National Energy Board periodically releases long-term projections of Canadian energy supply and demand as part of its Energy Futures series. Since 2007, the ENERGY 2020 model has been central to this analysis. This presentation will describe how the National Energy Board uses ENERGY 2020 to create the scenarios and sensitivity cases featured in the Energy Futures reports.

2 - Multi-stage Stochastic Optimization of an Energy System Model
Joseph DeCarolis, Assistant Professor, North Carolina State University, 2501 Stinson Drive, Campus Box 7908, Raleigh, NC, 27695, United States of America, jdecarolis@ncsu.edu, Kevin Hunter, Sarat Sreepathi

We perform multi-stage stochastic optimization of a simplified energy system. The system consists of roughly 30 technologies used to supply primary energy resources, refine petroleum, generate electricity, and serve end use demands. The model incorporates crude oil, natural gas, and coal prices as stochastic parameters. Results indicate that the energy system requires little recourse as uncertainty is revealed over a multi-decadal time horizon.

3 - Incorporating Endogenous Demand into Capacity Expansion Models for Developing Countries
Rhonda Jordan, PhD Candidate, Massachusetts Institute of Technology, 143 Albany Street, #201A, Cambridge, MA, 02139, United States of America, rjordan@mit.edu

Using a novel combination of approximate dynamic programming, system dynamics and linear programming, this research develops a power system capacity expansion model that incorporates both the technical details of power grid operation and the salient features of electricity demand in developing countries. Unlike traditional planning models, demand is represented endogenously. The capacity expansion strategies identified in this research are compared against that of more traditional approaches.

4 - A Dynamic Model for Sustainable Energy Policy Making in Spain
Alvaro Lopez-Peña, Comillas P. University, IIT, Santa Cruz de Marcenado 26, Madrid, 28015, Spain, alvaro.lopezpena@iit.upcomillas.es, Pedro Linares, Ignacio Pérez-Arriaga

Today, there is an important need for sound sustainable energy policies. For assessing them, mathematical models are needed, which allow to represent energy systems' evolution over the long term under different policy assumptions (trajectories). We present a dynamic model applied to Spain, which aims at representing realistic trajectories. By realistic, we mean that it takes into account important aspects of energy systems such as imperfect markets, investor's myopia and risk aversion.

■ SA41

41- North 227 B- CC

Models in Energy Investment

Contributed Session

Chair: Carlos Ruiz, École Centrale Paris and SupÈlec, Grande Voie des Vignes, Ch,tenay-Malabry, 92295, France, carlosruizmora@gmail.com

1 - On the Value of Improved Models for the Electricity Sector
Alberto Lamadrid, Graduate Student, Cornell University, 419 Warren Hall, Ithaca, NY, 14850, United States of America, ajl259@cornell.edu, Tim Mount, Ray Zimmerman, Robert Thomas

This paper measures the value of the stochastic solution for a system with high penetration of renewable energy sources, contrasting it to a deterministic formulation with fixed reserves, as used by System Operators (SO). The performance analysis focuses on measures of the system economic costs. Our model has a SO minimizing the expected cost of providing both energy and ancillary services with a security constrained OPF. Uncertainty is reproduced using a Markovian transition probability matrix.

2 - Mathematical Model for Planning Investments in Energy Sources for Argentina
Julio Rolando Flores, Becario, INGAR, Eva Peron 2660, Santa Fe, SF, 3000, Argentina, jflores@santafe-conicet.gov.ar, Jorge M. Montagna, Aldo Vecchietti

This paper presents a mathematical programming model for planning investment in energy sources for Argentina. The model considers the use of renewable and not renewable sources and uncertainties in demands, costs, and the amount of reserves of fossil fuels. The objective function of is to minimize the investment and operation costs of the energy supply. The results provide the visualization of the investments made: time periods in and their amounts and also how the energy matrix is affected.

3 - Biomass Based Energy Logistics System
Wooseung Jang, Professor, University of Missouri, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, jangw@missouri.edu, Rana Afzali Baghdadabadi, Cerry Klein, James Noble, Zhongwei Yu, Kurt Ehlers

We develop an optimization model supporting the multi-stage decision making of infrastructure investment and operation of the biomass logistics system. In addition, we build a database for biomass availability, cost and other supply information. Our work is applied to the biomass power plants scheduled to operate in Missouri.

4 - Transmission Expansion Planning using an AC Model: Formulations and Possible Relaxations
Hui Zhang, Research Associate, Arizona State University, 1223 S Dorsey Ln, Apt 101, Tempe, AZ, 85281, United States of America, hui.zhang@asu.edu, Hans Mittelmann, Vijay Vittal, Gerald Heydt

Starting with two MINLP models, this paper explores the possibility of applying AC-based models to the transmission expansion planning (TEP) problem. Two NLP relaxation models are then proposed by relaxing the binary decision variables. A reformulation-linearization-technique (RLT) based relaxation model is also presented in the paper. The simulation results show that by using proper reformulations or relaxations, it is possible to apply the AC models to TEP problems and obtain a good solution.

5 - Robust Reliability Optimization by System Design and Components Allocation
Carlos Ruiz, École Centrale Paris and Supèlec, Grande Voie des Vignes, Châtenay-Malabry, 92295, France, carlosruizmora@gmail.com, Rodrigo Mena, Enrico Zio, Yanfu Li

We address the problem of power system design and components allocation under multiple sources of uncertainty. We consider a set of fixed buses with uncertain demand loads and we seek to identify the electrical lines and generating units that should be installed in order to minimize the system operational cost and maximize its reliability. The optimization relies on a bilevel model that is robust against generation capacity variability as well as unit and line failures.

■ SA42

42- North 227 C- CC

Strategic Issues in Freight Transportation

Contributed Session

Chair: Zhougeng Lin, PhD Student, University of Portsmouth, Lion Gate Building, Lion Terrace, Portsmouth, PO1 3HF, United Kingdom, Zhougeng.Lin@Port.Ac,Uk

1 - Mixed Fleet Dispatching Optimization in Truckload Transportation
Hector A. Vergara, Visiting Assistant Professor, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, vergarah@onid.orst.edu, Sarah Root

In a mixed fleet dispatching system for truckload transportation some truckloads are sent direct point-to-point while others are routed through a network of relay points where drivers are exchanged allowing them to return home more frequently. We propose a mathematical formulation for strategic relay network design and dispatch mode selection that incorporates several operational constraints within the variable definition. Computational results are presented along with areas for future research.

2 - Freight Network Design with Pricing and Economies of Scale
Panagiotis Ypsilantis, PhD Candidate, RSM, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, pypsilantis@rsm.nl, Rob Zuidwijk

The freight service network design in a strategic level is formulated as a bi-level mathematical program; the pricing, design and economies of scale are considered in a competitive environment. The net revenues of a TOC that operates barge and train connections to inland terminals according to the extended gate concept are maximized while the total costs faced by the users of the network are minimized. A solution approach for this problem and some numerical results are presented and discussed.

3 - Freight Origin-destination Estimation using Bayesian Networks Based on Multiple Data Sources
Yinyi Ma, Erasmus University Rotterdam, Burg. Oudlaan 50, Rotterdam, Netherlands, yma@rsm.nl, Roelof Kuik, Henk van Zuylen

Freight origin-destination (OD) estimation becomes increasingly important. Traditional general traffic OD estimation methods based on loop detectors have the under-specification problem. This paper investigates a Bayesian Networks approach for estimating freight OD-matrices by Markov-chain-Monte-Carlo methods, thereby mitigating under-determinacy by exploiting proportionally-contributing multiple data sources, such as camera, Bluetooth and Weigh-in-Motion.

4 - Simulation and Multi-objective Optimization Combining Framework for Container Terminal Optimization
Zhougeng Lin, PhD Student, University of Portsmouth, Lion Gate Building, Lion Terrace, Portsmouth, PO1 3HF, United Kingdom, Zhougeng.Lin@Port.Ac,Uk, Dylan Jones

This presentation proposes a combining framework to integrate simulation and multi-objective optimization(MOO) for better description of dynamic real-world systems in low cost and reasonable computational time. A case study on container terminal equipment optimization is discussed to demonstrate its applications. Results are compared by post-MOO structure and integrated MOO structure.

■ SA43

43- North 228 A- CC

RAS Student Paper Award

Sponsor: Railway Applications

Sponsored Session

Chair: Juan Morales, BNSF Railway, TX, United States of America, Juan.Morales@BNSF.com

1 - RAS Student Paper Award
Juan Morales, BNSF Railway, TX, United States of America, Juan.Morales@BNSF.com

Finalists of the 2012 RAS Student Paper Award will present their work in this session. Finalists were not determined prior to the abstract submission deadline of the printed programs.

■ SA44

44- North 228 B- CC

Supply Chain Structures and Incentives

Contributed Session

Chair: Suleyman Demirel, PhD Candidate, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, sdemirel@umich.edu

1 - Agile Supply Chain Building via Semantic Supplier Search
Jaehun Lee, POSTECH, 312, Eng4, POSTECH, Hyoja, Pohang, Korea, Republic of, jaehun_lee@postech.ac.kr, Taejong Yoo, Hyunbo Cho, Bohyun Kim

The goal of a supply chain in manufacturing domain is to guarantee that the right amount of the right product is in the right place at the right time. To accomplish this, an agile supply chain formation is critical. We propose a semantic manufacturing supplier discovery framework that structuralizes buyer's demand requirements and supplier's capability information to assist in building such a supply chain.

2 - Supply Network Structure and Firm Innovation: An Empirical Investigation
Marcus Bellamy, Georgia Institute of Technology, 800 West Peachtree ST NW, Atlanta, GA, 30308, United States of America, marcus.bellamy@gatech.edu, Soumen Ghosh, Manpreet Hora

We investigate the impact of supply network structure on firm innovation. Using a network-analytic lens, we develop and test our hypotheses linking firm level network properties and innovation. Our analysis considers how firm innovation is affected through the extended network it shares between each entity in the supply network.

3 - The Effect of a Temporary Product Distribution Channel on Supply Chain Performance
Moutaz Khouja, Professor, University of North Carolina-Charlotte, 9201 University City Blvd., Charlotte, NC, 28223, United States of America, mjkhouja@uncc.edu

We analyze a supply chain of a manufacturer and two retailers. The first retailer always stocks the product. The second retailer is a deal-of-the day (DOTD) retailer who sells the product for a short time of few days at a discount. The DOTD retailer sells the product at a discount due to a price discount she gets for ordering a large quantity. We identify the discounted wholesale price and the discount order quantity. We find that he temporary channel can increase the profit of the manufacturer.

4 - Revisiting Interorganizational Trust: Is More Always Better or Could More Be Worse?
Veronica H. Villena, Assistant Professor, Pennsylvania State University, 410 Business Building, University Park, State College, PA, 16802, United States of America, vhv1@psu.edu, Thomas Choi, Elena Revilla

We conduct a more comprehensive examination of trust by considering both its positive and negative effects and by investigating how they function differently under different types of uncertainties.We use data from a sample of 133 buyer-supplier relationships. The results suggest that the negative effects of trust become more notable when there is high behavioral uncertainty between buyers and suppliers and less evident when there is high environmental uncertainty for buyers.

■ SA45

45- North 229 A- CC

JFIG Paper Competition I

Sponsor: Junior Faculty Interest Group

Sponsored Session

Chair: Esra Buyuktahtakin, Assistant Professor, Wichita State University, IME Department, Wichita, KS, United States of America, esra.b@wichita.edu

1 - JFIG Paper Competition
Esra Buyuktahtakin, Assistant Professor, Wichita State University, IME Department, Wichita, KS, United States of America, esra.b@wichita.edu

Papers are submitted for this year's JFIG paper competition, and each one is evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. In this session, finalists-selected in two rounds of review, will present their papers. For the selected finalists and the abstracts of the selected papers, please refer to the online program.

■ SA46

46- North 229 B- CC

Organizational and Industry Renewal (I): Innovation, Industry Context, and Population-Level Learning

Sponsor: Organization Science

Sponsored Session

Chair: Andreas Schwab, , Associate Professor, Iowa State University, 3315 Gerdin, Ames, IA, 50011, United States of America, aschwab@iastate.edu

1 - Exploring Organizational Identity and Organizational Design in Technological Transitions
Mary Tripsas, Associate Professor, Harvard Business School, 219 Rock Center, Soldiers Field Rd, Boston, MA, 02163, United States of America, mtripsas@hbs.edu

Innovation research suggests that a separate new technology unit with its own identity increases the odds of a successful technological transformation. Identity research, however, has shown that multiple identities can be harmful, posing a dilemma. Through a comparison of FujiFilm and Polaroid's reactions to digital imaging, we propose that establishing a separate new technology unit can cause dormant identity conflicts to surface, and reconciling those conflicts is critical to success.

2 - Ties that Bind? The Differential Ability of de alio and de novo Firms to Leverage External Relations

Glenn Hoetker, Associate Professor, W.P. Carey School of Business, Arizona State University, P.O. Box 874006, Tempe, AZ, 85287-4006, United States of America, Glenn.Hoetker@asu.edu, Pao-Lien Chen, Rajshree Agarwal

External relationships may help a firm learn about disruptive technological changes, but may also impede the firm's adopting new technologies. We examine the impact of a firm's pre-entry experience on its dynamic capability to maximize learning and minimize inertia created by ties to suppliers. We find that de alio firms better harness information available through a larger network of suppliers than de novo firms, but are equally constrained by the length of prior relationships.

3 - Whose Side Are You On? The Role of States in Influencing Healthcare Service Delivery Innovations

Scott Feyereisen, 4666 East Camino Rosa, Tucson, AZ, 85718, United States of America, feyerbal@email.arizona.edu, Joseph Broschak

We explore why all U.S. states would not adopt a seemingly rational, efficient and cost-reducing policy innovation. Using institutional and resource dependence theory, we develop and test hypotheses related to a state's propensity to adopt contested healthcare legislation. Professional power and heterogeneity, state resources and prior state adoptions are hypothesized to affect a state's likelihood of adopting a policy change. We test our predictions using data on anesthesia policy adoptions.

4 - Population-Level Learning: Industry-Level Variability of Learning Outcomes from Innovations

Andreas Schwab, Associate Professor, Iowa State University, 3315 Gerdin, Ames, IA, 50011, United States of America, aschwab@iastate.edu, Jay O'Toole, Anne Miner

This study investigates industry-level variability in learning outcomes following the implementation of an innovation. We challenge the intuition that early periods are marked by more variation than later periods. Contingency factors that shape variability include varied imitation rules, deliberate innovation, and interactions across innovation features and levels of learning. We test hypotheses using historic data on the farm-system, an administrative innovation in baseball industry.

■ SA47

47- North 230- CC

New Advances in Traffic Operations

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Carolina Osorio, Assistant Professor, Massachusetts Institute of Technology, Room 1-232, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, osorioc@mit.edu

1 - Combining Metamodel Techniques and Bayesian Selection Procedures to Derive Computationally Efficient Traffic Management Algorithms

Hoda Bidkhori, Massachusetts Institute of Technology, 77 Massachusetts Ave., Room 1-172, Cambridge, MA, 02139, United States of America, bidkhori@mit.edu, Carolina Osorio

This talk introduces simulation-based optimization (SO) methods to address the problems in Traffic Management. It proposes an SO technique that uses metamodel information together with a Bayesian framework, where the parameters of the prior distributions are estimated based on probabilistic metamodel information. In order to derive an SO algorithm that achieves a good trade-off between detail, realism and computational efficiency, the metamodel combines information from a highresolution traffic simulator with information from a lower-resolution yet computationally efficient analytical queueing network model. We use this approach to address an urban traffic management problem using a detailed microscopic traffic simulator of the Swiss city of Lausanne.

2 - Application of Online DTA Framework for Weather-related Traffic Management

Hani S. Mahmassani, Northwestern University, Evanston, IL, 60208, United States of America, masmah@u.northwestern.edu, Ying Chen, Jiwon Kim, Lan Jiang

Weather-related traffic management through variable message signs, speed control and active demand management is an important application for predictive traffic estimation and prediction based on online DTA deployments. A framework and associated methodology is presented and demonstrated through several applications.

3 - On Observable Chaotic Maps for Transportation Queueing Analysis

Joseph Y.J. Chow, Assistant Professor, Ryerson University, 350 Victoria Street, Toronto, ON, M5B 2K3, Canada, joseph.chow@ryerson.ca

Chaotic mapping can capture a number of characteristics in queues: transient behavior, intermittency, steady state, and complex distributions. The proposed queueing model uses chaotic mapping of inter-arrival times to generate arrivals so that parameters can be calibrated with observable data. A sample mapping based on the logistic map is presented and shown to be ergodic. A joint parameter and state estimation algorithm is presented. The advantages are studied with two connected nodes.

■ SA48

48- North 231 A- CC

Maritime Transportation

Contributed Session

Chair: Dimitri Papageorgiou, PhD Candidate, Georgia Tech, 765 Ferst Ave, Atlanta, GA, 30332, United States of America, djpapag@gatech.edu

1 - Evaluation of Intermodal Marine Container Terminal Gate Strategies via Simulation

Jeffery Karafa, University of Memphis, 104 Engineering Science Bldg, 3815 Centr, 3815 Central Avenue, Memphis, TN, 38152, United States of America, jefferykarafa@yahoo.com, Mihalis Golias

We present the development of a traffic simulation model to measure the impact of gate strategies on congestion levels at intermodal marine container terminal gates. The traffic model is used to quantify both travel time and delay and emission levels at the terminal gates before and after gate strategies have been implemented.

2 - Equilibrium Model for Analysis on Opening and Improving Transportation Routes

Kazuhiko Ishiguro, Kobe University, 5-1-1, Fukaeminami, Higashinada, Kobe, 658-0022, Japan, ishiguro@maritime.kobe-u.ac.jp, Pitu Mirchandani

Transport cost reduction will trigger new transport demand. This study develops international trade model taking account of ocean carriers' behavior based on multi-regional computable general equilibrium framework. Trade amount is formulated as the demand of goods produced in other region. The model is applied to opening and improving transportation routes and the impacts on trade are discussed.

3 - Quickly Finding Good Solutions to Large-scale Maritime Inventory Routing Problems

Dimitri Papageorgiou, PhD Candidate, Georgia Tech, 765 Ferst Ave., Atlanta, GA, 30332, United States of America, djpapag@gatech.edu

We describe aggregation and decomposition techniques for quickly finding good solutions to large-scale maritime inventory routing problems. Solving the LP relaxation of the "standard" mixed-integer programming formulation of these problems can require hours to solve, assuming they can be loaded into memory. Meanwhile, our goal is to find high quality solutions in minutes. We present methods that accomplish this objective and compare them to two benchmarks that have been used in the literature.

■ SA49

49- North 231 B- CC

Joint Session TSL/SPPSN: Geographic, Building and Pedestrian Evacuation Modeling

Sponsor: Transportation Science & Logistics & Public Programs, Service and Needs

Sponsored Session

Chair: Douglas Bish, Assistant Professor, Virginia Tech, Department of Industrial and Systems Eng., 250 Durham Hall, Blacksburg, VA, 24061-0118, United States of America, drb1@vt.edu

1 - Simulating Pedestrian Evacuation from Large Events
Pitu Mirchandani, Arizona State University, 699 South Mill Avenue, Tempe, AZ, 85287, United States of America, pitu@asu.edu, Ning Wang, Zhuoyang Zhou

At the end of a large event, attendees move from their seats to an exit, and then walk over to the vehicle, which they subsequently use to reach their ultimate destination. This paper develops a simulation model, using the pedestrian feature in VISSIM, to evaluate delays in normal and no-notice evacuation scenarios. Evacuation strategies are studied to make total evacuation time to leave the building or stadium and reach respective destinations as small as possible.

2 - Pedestrian Route Choice Modeling in a Changing Physical Environment
Lei Feng, University of Maryland, College Park, MD, United States of America, lfeng@umd.edu, Elise Miller-Hooks

The selection of routes in a congested pedestrian network in which the physical environment is changing is explored. Models of route choice behavior in this environment are developed. The evolving physical conditions, improving pedestrian situational awareness, responsively changing goals, and individual and collective responses are explicitly recognized in these models of route choice.

3 - Fleet Management and Equity Measures in Evacuation Transportation Planning for Multiple Hospitals
Esra Agca, PhD Student, Virginia Tech, Department of Industrial and Systems Eng., 250 Durham Hall, Blacksburg, VA, 24061, United States of America, esra.vt@gmail.com, Douglas Bish, Roger Glick

A coordinated response is required for to effectively evacuate multiple hospitals due to a regional threat (e.g., a hurricane). Organizing the evacuation response can be more complicated when it involves more than one hospital system (groups of hospitals under the same management). In this research we study optimal evacuation plans for multiple hospitals, including full centralized control, and the study of equity issues at various levels, including at the hospital system level.

4 - Optimizing a Large Scale Evacuation Plan for Tucson, AZ
Neema Nassir, Graduate Research Assistant, University of Arizona, Department of Civil Engineering and Engineering Mechanics, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, neeman@email.arizona.edu, Hong Zheng, Mark Hickman, Yi-Chang Chiu

Every year hundreds of chlorine tankers pass through downtown Tucson. This study aims to optimize evacuation under a hypothetical tanker spill. Current gas dispersion models indicate that such a spill may lead to deadly consequences for many persons in this large urban area. In our evacuation model, the objective is to minimize the total exposure of the citizens to the poisonous gas, taking into account the different concentration levels of gas over the space.

■ SA50

50- North 231 C- CC

Military Applications

Sponsor: Military Applications

Sponsored Session

Chair: Sung-Pil Kim, Yonsei University / R.O.K Navy, Yonseiro 50, Seoul, Korea, Republic of, senseksp@gmail.com

1 - Modeling Multi-echelon Inventories for Naval Repair Parts in the ROK Navy
Sung-Pil Kim, Yonsei University/R.O.K Navy, Yonseiro 50, Seoul, Korea, Republic of, senseksp@gmail.com

In comparison to the rapid modernization of defense equipment, government resources are restricted, necessitating an efficient solution for managing all national resources, including naval repair parts.This paper investigates the modeling of efficient multi-echelon inventory management of naval repair parts in the ROK Navy.

2 - Once More: Putting the "O" Back into Military Operations Research
George Kuhn, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States of America, GKuhn@lmi.org

Research results are described for two core military management topics: estimating Forces personnel attrition (casualty estimation), and forecasting unit-level requirements for aircraft (helicopter) spare parts. While being clearly different planning domains on one level, at another level the difficulties that have long burdened estimating/forecasting such requirements share a common root: unless data collection and analysis are grounded on capturing and reflecting the inherent character of military operations, estimates/forecasts will inevitably fail to describe requirements accurately. Evidence is presented that, properly grounded on describing patterns of military operations, quantitative analysis can project requirements accurately—and these results differ markedly from standard portrayals that rely on conceptual and quantitative conventions incongruent with the underlying character of military operations.

■ SA51

51- North 232 A- CC

Disaster Relief Planning and Operations

Sponsor: Military Applications

Sponsored Session

Chair: Xiaofeng Nie, Assistant Professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798, Singapore, xiaofengnie@ntu.edu.sg

1 - Prepositioning of Supplies in Preparation for a Hurricane with Forecast Information Updates
Rajan Batta, University at Buffalo (SUNY), Dept. of Industrial & Systems Engg, Buffalo, NY, 14260, United States of America, batta@buffalo.edu, Gina Galindo

It is possible to use prediction models to obtain periodic forecasts about a hurricane's main characteristics such as its path, wind force and time of landfall. Using this information we present a dynamic model for prepositioning supplies in such a setting. Our model has two distinguishing features: possible destruction of supply points during the disaster event, and the use of forecast information updates in order to strategically modify and improve the prepositioned quantities and locations.

2 - A Stochastic Programming Model for Casualty Response Planning during Catastrophic Health Events
Aakil Caunhye, PhD Student, Nanyang Technological University, 758, Choa Chu Kang North 5, Singapore, 680758, Singapore, M090028@e.ntu.edu.sg, Xiaofeng Nie

Catastrophic health events are natural or man-made incidents that create casualties in numbers that overwhelm healthcare response capabilities. We construct a three-stage stochastic programming model to locate alternative care facilities and transport casualties in response to such events. We also propose an L-shaped cut algorithm, to generate good solutions fast. We analyse the model and algorithm in the case of a high-impact earthquake in a subregion of San Bernardino, California.

3 - Identifying the Role and Impact of Social Media in Evacuation
Justin Yates, Assistant Professor, Texas A&M University, 4079 ETB, 3131 TAMU, College Station, TX, 77843-3131, United States of America, jtyates@tamu.edu

The next generation of evacuation planning and emergency response strategies needs to be built on the context of real-time information dissemination. The goal of this research is to build a new set of evacuation models capable of incorporating spatio-temporal data on extremely large scales and supported by new behavioral paradigms predicated on the use of social media. We discuss our initial efforts and insights in this presentation.

4 - Heuristic Methods for Hazard Zone Determinations
Ed Pohl, University of Arkansas, Department of Industrial Engineering, Fayetteville, AR, United States of America, epohl@uark.edu, Manuel D. Rossetti

To better examine the use of optimization in emergency planning this research investigates the determination of hazard zones within a geographic area. A hazard zone is an area corresponding to a worst-case evacuation scenario and is a potential vulnerability that should be addressed by risk mitigation strategies. The research compares two heuristic approaches to determining hazard zones based on population and road connectivity within a spatial network.

■ SA52

52- North 232 B- CC

Electricity Markets: Game-theory Based Models for Strategic Planning

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Efraim Centeno, Institute for Research in Technology - ICAI, Comillas Pontifical University, Alberto Aguilera 25, Madrid, 28015, Spain, Efraim.Centeno@upcomillas.es

1 - Study of Strategic Behavior Impact in the Spot Market on Capacity Expansion using a Linearised EPEC

Efraim Centeno, Institute for Research in Technology-ICAI, Comillas Pontifical University, Alberto Aguilera 25, Madrid, 28015, Spain, Efraim.Centeno@upcomillas.es, Sonja Wogrin, Julian Barquin

Capacity expansion decisions are represented using a bilevel approach (EPEC). In the upper level the competing generation companies maximize their individual profits, while the lower level represents the spot markets using a conjectured price-response approach. This model is linearised and solved to show the solution variation with respect to the level of competence in the spot market and that the market equilibrium can have multiple solutions with investments level that vary significantly.

2 - Impact of Renewable Energy Sources on Generation Capacity Investments: A Stochastic MPEC Approach

Sonja Wogrin, Institute for Research in Technology-ICAI, Comillas Pontifical University, Alberto Aguilera 25, Madrid, 28015, Spain, sonja.wogrin@iit.upcomillas.es, Julian Barquin, Efraim Centeno

Strategic long-term generation capacity planning in liberalized electricity markets is a very complicated task, mainly because generation companies are confronted with a vast spectrum of uncertainties, one of the most prominent being demand fluctuations stemming from renewable energy sources. We propose a stochastic bilevel model formulated as an MPEC to analyze the impact that renewable-induced uncertainty has on capacity investment decisions and the optimal technology mix in the system.

3 - A Three-level Model for Generation and Transmission Expansion Planning

Javier Contreras, Professor, University of Castilla-La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, 13071, Spain, Javier.Contreras@uclm.es, Enzo Sauma, David Pozo

We present a three-level model for the expansion of an electric network. The lower-level model represents the equilibrium of a pool-based market; the intermediate level represents the Nash equilibrium in generation expansion, and the upper-level model represents the anticipation of transmission expansion to the investment in generation and the pool-based market equilibrium. The model is applied to a realistic power system in Chile to illustrate the methodology and proper conclusions are reached.

4 - Dynamic Pricing of Peak Generation in Electricity Markets

Heikki Peura, PhD Student, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, hpeura.phd2010@london.edu, Derek Bunn

With reference to electricity, we study the problem of pricing peak production of an instantly perishable product in a dynamic setting with market power. In a repeated game with future demand uncertainty, peak producers' profitability may hinge on their ability to implicitly collude on prices. Furthermore, diversification in generation technologies as well as financial constraints in the form of revenue targets may have significant impacts on peak producers' pricing decisions.

■ SA53

53- North 232 C- CC

Optimization in Energy Procurement and Cost Allocation

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Ross Baldick, Professor, The University of Texas at Austin, 1 University Station Stop C0803 ENS 502, Austin, TX, 78712, United States of America, baldick@ece.utexas.edu

1 - Energy Supply Risk Due to Selling Over the Physical Generation Capacity

Anderson Rodrigo de Queiroz, PhD, MC&E, Rua Silvestre Ferraz N.81, Itajubá, 37500-000, Brazil, ar_queiroz@yahoo.com.br, Josè W. Marangon Lima, Luana M. Marangon Lima, Verònica Etchebehere

In Brazil the electricity market agents have to present full physical generation coverage, in other words only the generator's assured energy can be negotiated. This work explores the possibility of financial leverage in terms of energy by allowing the negotiation of contracts that extrapolates the physical capacity. Short-term price simulations are used to value contracts and to study risk. The procedure gives more flexibility and liquidity to the market amplifying the business possibilities.

2 - Game-theoretic Allocation of Transmission Costs Taking into Account Generation and Load Uncertainties

Luiz Carlos Costa Jr, PSR, Praia de Botafogo 228/1701-A, Rio de Janeiro, RJ, 22250-145, Brazil, luizcarlos@psr-inc.com, Luiz Mauricio Thomè, Silvio Binato, Mario Veiga Pereira

We extend the Aumann-Shapley allocation scheme to represent uncertainties in bus loads and energy production of renewables. Two criteria are compared: a marginal pricing scheme, in which the cost of each circuit is allocated to the scenario that led to the maximum use of that circuit; and a "tolling" scheme, in which the cumulative distribution of circuit usage is taken into account. The methodology will be illustrated for the 5,000 bus Brazilian transmission network.

3 - Stochastic Model of International Fuel Procurement for Coal-fired Plants in Hydrothermal Systems

Fernanda Thomé, Research Engineer, PSR, Praia de Botafogo 228/1701-A, Rio de Janeiro, RJ, 22250145, Brazil, fernanda@psr-inc.com, André Dias, Silvio Binato, Eduardo Faria

This work presents an optimal strategy for international fuel procurement, transportation and storage in order to ensure continuous supply of coal-fired thermal plants. A stochastic programming problem takes into account the uncertainty associated with inflows in a hydrothermal system and other complex logistical and commercial aspects related to imported coal handling. The model results are shown by comparisons between different strategies when applied to different dispatch scenarios.

■ SA54

54- Regency Ballroom A- Hyatt

Nicholson Student Paper Prize I

Cluster: Nicholson Student Paper Prize

Invited Session

Chair: Ashish Goel, Stanford University, Stanford, CA, United States of America, ashishg@stanford.edu

1 - A Polyhedral Study of Multiechelon Lot Sizing with Intermediate Demands

Minjiao Zhang, Graduate Research Associate, The Ohio State University, Integrated Systems Engineering, 1971 Neil Ave., Columbus, OH, 43210, United States of America, zhang.769@osu.edu, Simge KüÁükyavuz, Hande Yaman

In this paper, we study a multiechelon uncapacitated lot-sizing problem in series (m-ULS), where the output of the intermediate echelons has its own external demand and is also an input to the next echelon. We propose a polynomial-time dynamic programming algorithm, which gives a tight, compact extended formulation for the two-echelon case (2-ULS). Next, we present a family of valid inequalities for m-ULS, show its strength, and give a polynomial-time separation algorithm. We establish a hierarchy between the alternative formulations for 2-ULS. In particular, we show that our valid inequalities can be obtained from the projection of the multicommodity formulation. Our computational results show that this extended formulation is very effective in solving our uncapacitated multi-item two-echelon test problems. In addition, for capacitated multiitem, multiechelon problems, we demonstrate the effectiveness of a branch-and-cut algorithm using the proposed inequalities.

2 - Robust Queueing Theory

Chaithanya Bandi, PhD Student, Massachusetts Institute of Technology, Cambridge, MA, 02139, United States of America, cbandi@mit.edu, Dimitris Bertsimas, Nataly Youssef

We propose an alternative approach for studying queueing systems by employing robust optimization as opposed to stochastic analysis. While traditional queueing theory relies on Kolmogorov's axioms of probability and models arrivals and services as renewal processes, we use the limit laws of probability as the axioms of our methodology and model the queueing systems primitives by uncertainty sets. In this framework, we obtain closed form expressions for the waiting times in multi-server queues with heavy-tailed arrival and service processes. These expressions are not available under traditional queueing theory for heavy-tailed processes, while they lead to the same qualitative insights for independent and identically distributed arrival and service times. We also develop an exact calculus for analyzing a network of queues with multiple servers based on the following key principle: a) the departure from a queue, b) the superposition, and c) the thinning of arrival processes have the same uncertainty set representation as the original arrival processes. We show that our approach, which we call the Robust Queueing Network Analyzer (RQNA) a) yields results with error percentages in single digits (for all experiments we performed) relative to simulation, b) performs significantly better than the Queueing Network Analyzer (QNA) proposed in Whitt [1983], and c) is to a large extent insensitive to the number of servers per queue, the network size, degree of feedback, traffic intensity, and somewhat sensitive to the degree of diversity of external arrival distributions in the network.

3 - New Functional Characterizations and Optimal Structural Results for Assemble-to-order M-Systems

Emre Nadar, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, enadar@andrew.cmu.edu, Alan Scheller-Wolf, Mustafa Akan

We consider an assemble-to-order M-system with multiple components, multiple products, batch ordering of components, random lead times, and lost sales. We model the system as an infinite-horizon Markov decision process and seek an optimal control policy: a control policy specifies when a batch of components should be produced, and whether an arriving demand for each product should be satisfied.We introduce new functional characterizations for submodularity and supermodularity restricted to certain subspaces. These enable us to characterize optimal inventory replenishment and allocation policies under a mild condition on component batch sizes via a new type of policy: lattice-dependent base-stock production and lattice-dependent rationing.

■ SA55

55- Regency Ballroom B - Hyatt

Supply Chain and Operations Issues in Emerging Economies

Cluster: Operations Research in Emerging Economies

Invited Session

Chair: Mili Mehrotra, University of Minnesota, 321 19th Ave. South, Minneapolis, MN, United States of America, milim@umn.edu

Co-Chair: Tharanga Rajapakshe, Assistant Professor, University of Florida, Warrington School of Business Administra, Gainesville, FL, 32606, United States of America, Tharanga.rajapakshe@warrington.ufl.edu

1 - Improving Agricultural Productivity: Impact of Minimum Support Prices

Tharanga Rajapakshe, Assistant Professor, University of Florida, Warrington School of Business Administra, Gainesville, FL, 32606, United States of America, Tharanga.rajapakshe@warrington.ufl.edu

A Minimum Support Price (MSP) for an agricultural crop is a guaranteed price, regardless of volume, at which a governmental entity agrees to purchase the crop from farmers. This work is an effort to understand the influence of MSP on a homogenous farming community cultivating a single crop. We analyze the impact of production cost and yield uncertainty on the MSP. Our results explain the role of MSP in improving productivity and social utility.

2 - Improving the Milk Supply Chain in Developing Countries: Analysis under Competing Intermediaries

Liying Mu, University of Texas at Dallas, 800 W. Campbell Road, Richardson, TX, 75080, United States of America, muliying@utdallas.edu, Milind Dawande, Vijay Mookerjee

Quality issues in milk – arising primarily from deliberate adulteration by producers — have been reported in many developing countries. High testing cost and competition between milk stations (which act as intermediaries by buying milk from producers and selling it to firms) are identified as the main causes for the low quality of milk. We propose a mechanism to incentivize high-quality milk with minimum testing, in the presence of competing milk stations.

3 - A Stochastic Optimization Based Decision Support System for Planning in a Process Industry

Goutam Dutta, Professor, Indian Institute of Management, Production Quantitive Methods Area, Ahmedabad, Gujarat, Gu, 380015, India, goutam@iimahd.ernet.in, Narain Gupta, Robert Fourer

We introduce a multi-period, multiple scenario optimization based decision support system. The DSS is based on a two stage stochastic linear program with recourse for strategic planning in process industry. The model maximizes expected contribution subject to material balance, facility capacity, and constraints for non-anticipativity. We describe how the database structure for the stochastic optimization model is different in comparison to the multi-period deterministic model.

4 - Agricultural Cooperatives for Alleviating Poverty: Models and Analyses

Jaehyung An, PhD Student, UCLA Anderson School of Management, 11140 Rose Ave. #405, 90034, Los Angeles, CA, 90034, United States of America, jaehyung.an.2013@anderson.ucla.edu, Soo-Haeng Cho, Christopher Tang

In emerging markets such as Brazil, China and India, the agricultural sector plays an important role in their economic growth even though many farmers in these markets are trapped in the poverty cycle. To break this vicious cycle, government agencies, Non-Governmental Organizations, and social enterprises are helping farmers to establish agricultural cooperatives (coops). In this paper, we analyze the impact of these coops on the production quantities, as well as their impact on the market.

■ SA56

56- Curtis A- Hyatt

Strategy and Strategic Planning

Contributed Session

Chair: Jay Lee, California State University Sacramento, 6000 J St., Tahoe Hall 2079, Sacramento, CA, 95819, United States of America, jlee@csus.edu

1 - Applying Synthetic Control Methodology in Management Research: Analyzing the Impact of Government Assistance on Chrysler's Performance

Brian Richter, Assistant Professor of Business, Economics, and Public Policy, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street North, London, ON, N6A3T9, Canada, brian.richter.@mccombs.utexas.edu, Adam Fremeth, Guy Holburn

We introduce synthetic control to management research by demonstrating how to apply the technique to quantify the effects of managerial interventions when a single observation unit receives a treatment on a single date. The problem with such scenarios is that counterfactual data is typically lacking. The method, however, allows us to generate counterfactual data systematically from among untreated firms. In our application, we assess the impact of government assistance on Chrysler's performance.

2 - New Methodology for the Mandatory Minimal Outflow Representation on Hydrothermal Ssystems Planning

Wellington Conceicão, Instituto Federal de Educacão e Tecnologia, Campus IFET, Juiz de Fora, Brazil, wellingtcc@yahoo.com.br, André Marcato, Joao Passos Filho, Rafael Brandi, Tales Ramos, Ivo Silva Junior

This work presents an alternative methodology to supply the mandatory minimum outflow in the problem of long-term operation planning of hydrothermal interconnected systems. It was used the strategy of trying to maintain the storage reservoirs within safe levels through a minimum curve of stored energy level. The simulation results shows that when using this formulation a decrease in the minimum outflow deficit is obtained.

3 - Game Theoretic Analysis of Inter-firm R&D Expenditure Distribution in Semiconductor Manufacturing

Tom Heaps-Nelson, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA, 02139-4301, United States of America, heaps@mit.edu

Soaring R&D and capital investment costs has left the semiconductor industry with a handful of large chipmakers and semiconductor equipment suppliers. This paper employs non-cooperative game theory along with detailed empirical estimates of firm payoffs as a framework for understanding how the largest industry players are likely to share the burden of R&D funding for two ongoing industry-wide process technology transitions: EUV lithography and 450mm wafers.

4 - Market Partitioning and Competitive Dynamics in Network-based Industries

Jay Lee, California State University Sacramento, 6000 J St., Tahoe Hall 2079, Sacramento, CA, 95819, United States of America, jlee@csus.edu

This paper looks at how market partitioning framework is evolved at network-based industry level where mature and emerging players compete with each other in a dynamic environment, and finally several propositions for further studies will be briefly discussed at the end.

5 - A Persuasive Power to Accept Change

Mohammad Z. Bsat, Associate Professor, National University, 11736 Vail Court, San Diego, CA, 92131, United States of America, mbsat@nu.edu

TQM principles made organizations more competitive. Higher education institutions should embrace TQM practices to undergo transformation & reverse the lagging effectiveness they suffer from. The efforts to improve education quality are hindered by the competition that controls higher education institutions. A collaborative approach to applying TQM principles can lead to a true transformation of higher education This paper addresses the issue of overhauling the overall quality of higher education.

■ SA57

57- Curtis B- Hyatt

Bayesian Approach

Contributed Session

Chair: Douglas Jones, Rutgers Business School, 2000 Margerum Avenue, Lake Como, NJ, 07719, United States of America, dhjones@rci.rutgers.edu

1 - The Economically Designed Multivariate Bayesian Control Chart for Short-run Production

Pengwei Zhang, Xiían Jiaotong University, Xi'an, Shaanxi, P.R.China, Xiían, China, kimi.2004@stu.xjtu.edu.cn, Qin Su

It has been known that Bayesian control charts are optimal tools for statistical process control but few results have been regarding the influence of the disturbance occurrence time on process cost. Based on new partition of process state, process transition matrices under different scenarios were constructed in this paper employing Markov chain method. Cost function was constructed iteratively, and finally optimization model for short-run production was formulated.

2 - A Bayesian Approach for Model Selection in Fractionated Split Plot Robust Design Experiments

Matthias Tan, Student, Georgia Institute of Technology, 251, 10th St. NW, Tenth and Home E TAE 208A, Atlanta, GA, 30318, United States of America, mtan6@gatech.edu, C.F. Jeff Wu

This paper proposes a Bayesian method for model selection in fractionated robust design experiments that are run as split plot experiments. We employ a Bayesian hierarchical model that takes into account the split plot error structure. Forward selection and combined global and local search algorithms are proposed to find models with high posterior probabilities. The proposed method is used to analyze three real experiments.

3 - An Optimization Approach to Approximate Bayesian Inference of Complex Systems

Jose Lainez, Purdue University, 480 Stadium Mall Drive, West Lafayette, IN, United States of America, jlainez@purdue.edu, Linas Mockus, Seza Orcun, Gary Blau, Gintaras Reklaitis

Monte Carlo approaches have been widely used for inference. The drawback of these methods is that they may be computationally expensive. Variational methods for approximate inference can provide efficient alternatives. However, the ones developed so far have been targeted for relative simple models. Here, we propose a variational approach that can handle models expressed as a set of differential-algebraic equations and whose posterior approximation is represented by a multivariate distribution.

4 - Predicting Material Accounting Misstatements: A Bayesian Approach

Feng Xu, Georgia Southwestern State University, 800 GSW State University Drive, Americus, GA, 31709, United States of America, fenghsu@hotmail.com, Zinan Zhu

In this paper, we develop Bayesian models for predicting accounting misstatements. The outputs of the models are probabilistic descriptions for the risk of conducting misstatement and posterior comparison of the riskiness between different firms. Empirical analysis results suggest that, compared to classical models, the Bayesian prediction models improve in terms of reliability and sensitivity, which provides a useful tool to assess materials accounting misstatement risks.

5 - Bayesian Updating of Norming Tables

Douglas Jones, Rutgers Business School, 2000 Margerum Avenue, Lake Como, NJ, 07719, United States of America, dhjones@rci.rutgers.edu, Marco Cors-Lozada

The distribution of the observed test score is estimated by nonparametric Bayesian methods based on mixture distributions where the mixing weights are obtained from a Dirichlet Process. We introduce the Dirichlet Processes and related Markov Change Monte Carlo simulation. The predictive posterior distribution is used to estimate the norming table. Prior information is used in the base distribution of the Dirichlet Process.

■ SA58

58- Phoenix East- Hyatt

Dynamic Control Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Mark Lewis, Professor, Cornell University, School of Ops Research and Inform. Engin, 226 Rhodes Hall, Ithaca, NY, 14853, United States of America, mark.lewis@cornell.edu

1 - Dynamic Exploration with Alternative Technologies: When to Stop Surveying and Invest

Nur Sunar, PhD Candidate, Stanford University, Graduate School of Business, Stanford, CA, United States of America, nsunar@stanford.edu, J. Michael Harrison

We consider an oil exploration and production company that can use various costly technologies to survey a given site, thus reducing uncertainty about the value of the site. Using a continuous-time Bayesian framework, we characterize the optimal exploration policy, and the conditions under which it is optimal to stop surveying and invest in (or abandon) the site.

2 - Optimal Hiring and Job Assignment

Martin Reiman, DMTS, Alcatel-Lucent Bell Labs, 600 Mountain Ave., Murray Hill, NJ, 07974, United States of America, marty@research.bell-labs.com, Yue Jin

We consider a model with two types of workers, novices and experts, who process a Poisson stream of jobs. The available controls involve hiring of novice workers and assignment of jobs to workers. Novices are promoted after sufficient work experience, and all workers eventually retire. This problem decomposes naturally into two time scales, motivating the use of results from nearly completely decomposable Markov decision processes in our analysis.

3 - Ambulance Allocation using Multi-Class Queueing

Mark Lewis, Professor, Cornell University, School of Ops Research and Inform. Engin, 226 Rhodes Hall, Ithaca, NY, 14853, United States of America, mark.lewis@cornell.edu, Kenneth Chong, Shane Henderson

We consider the problem of allocating various types of emergency calls to emergency response vehicles. One set of vehicles is typically used for more serious calls while the other for less serious. However, when all of one kind are busy, the other may be allocated to an incoming call. The difficulty is in the fact that mismatching ambulances to calls leaves the system with the vulnerability of having to allocate an ambulance to a call that it is ill-equipped to handle.

4 - Non-collaborative Systems with Setup Costs

Tugce Isik, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, tugceisik@gatech.edu, Sigrùn Andradòttir, Hayriye Ayhan

We study a system of two tandem queues with a finite buffer and two flexible servers. The servers are unable to collaborate and constant setup costs are incurred when the servers move between stations. We investigate how the server assignment policy that maximizes the long-run average profit depends on the magnitude of the setup cost. The optimal policy is characterized for different buffer sizes.

■ SA59

59- Phoenix West- Hyatt

Many-server Queues: Approximations and Control

Sponsor: Applied Probability

Sponsored Session

Chair: Itai Gurvich, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, i-gurvich@kellogg.northwestern.edu

1 - Impatience Differentiation in Large-scale Service Systems with Customer Reentrance

Guodong Pang, Assistant Professor, Pennsylvania State University, University Park, PA, United States of America, gup3@engr.psu.edu, Weining Kang

We consider large-scale service systems where customers need to reenter the system to fulfill their further service requests and the reentry may happen after some random delay time. We assume that the patience times of new and reentrant customers may have different distributions. Under mild assumptions on the general interarrival, service, delay and patience delay times, we investigate the impact of the impatience differentiation upon the service performance in such systems.

2 - Staffing and Control for Call Center Outsourcing with Rework

Jiheng Zhang, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, Hong Kong-PRC, j.zhang@ust.hk, Jin Fang, Eser Kirkizlar

We study a system with both in-house and outsourcer call centers. With certain probability, customers need to be rerouted to the in-house call center for further help after receiving service at the outsourcer. The pooling of the two call centers is allowed. Using a fluid approximation in a heavy traffic regime, we jointly determine the optimal control rule and the staffing policy that asymptotically minimize the staffing cost and long run holding cost subject to a service level constraint.

3 - Non-FCFS Scheduling in Fluid Many-server Queues

Petar Momcilovic, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petar@ise.ufl.edu, Avishai Mandelbaum

We consider non-FCFS scheduling policies in many-server fluid queues. In particular, we examine time-varying queues under the assumption that the scheduler knows realizations of customer patience/service times. Implementing a non-FCFS policy improves the overall system performance in terms of the number of customers that abandon during overloaded periods.

4 - Scheduling Parallel Servers in the Non-degenerate Slowdown Diffusion Regime: Asymptotic Optimality

Itai Gurvich, Northwestern University-Kellogg School of Management, Evanston, IL, United States of America, i-gurvich@kellogg.northwestern.edu, Rami Atar

We consider the problem of minimizing holding costs in a parallel-server system operating in a many-server heavy-traffic regime with non-degenerate slowdown (NDS). The NDS many-server regime is distinct from existing heavy-traffic regimes. As in the conventional heavy-traffic regime, the asymptotics are captured by a Brownian control problem, the solution of which exhibits state-space collapse. We prove an asymptotic lower bound and construct a sequence of asymptotically optimal policies.

■ SA60

60- Remington- Hyatt

Joint Session RM/Aviation: Robust Airline Optimization, Alliances and Revenue Sharing

Sponsor: Revenue Management & Pricing & Aviation Applications

Sponsored Session

Chair: Milind Sohoni, Indian School of Business, Gachibowli, Hyderabad, 500032, India, milind_sohoni@isb.edu

1 - Reducing Flight Delays by Optimizing Block-time Allocation

Mazhar Arikan, University of Kansas, School of Business, Lawrence, KS, United States of America, mazhar@ku.edu, Vinayak Deshpande, Milind Sohoni

In this paper, we develop an approach to reallocate block-times across the network of an airline and analyze the trade-off between total network arrival delay minutes and network-wide block-time budget based on a stochastic travel-time model. Using data acquired from a major U.S. airline, we construct an efficient frontier by optimally allocating block-times while considering target on-time arrival probability for each flight in the network.

2 - Robust Gate Assignment to Reduce Tarmac Waiting Time

Amy Cohn, University of Michigan, Ann Arbor, MI, United States of America, amycohn@umich.edu, Ryan Chen

We study the problem of assigning flights to gates at an airport, with the goal of reducing delay associated with an inbound flight waiting on the tarmac because its gate is still occupied by the preceding outbound flight. This can happen because the outbound flight is late leaving, the inbound flight is early arriving, or both. We develop MIP models to assign flights to gates so as to recognize the inherent stochasticity of the system, and provide empirical analysis based on these models.

3 - Revenue Sharing in Airline Alliances

Xing Hu, Assistant Professor, University of Oregon, 484 Lillis Hall, 1208 University of Oregon, Eugene, OR, 97401, United States of America, xingh@uoregon.edu, Rene Caldentey, Gustavo Vulcano

We study codeshare, the practice of independent airlines collaboratively marketing and operating fights. We propose a two-stage hierarchical approach to study the revenue sharing rules and decentralized inventory controls from both cooperative and non-cooperative game approach. Through both analytical and numerical studies, we find that revenue sharing rule affects the system significantly. We identify the existence and uniqueness of an admissible and efficient revenue sharing.

■ SA61

61- Russell- Hyatt

Aviation Support Operations

Sponsor: Aviation Applications

Sponsored Session

Chair: Wenwei Cao, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, cww@gatech.edu

1 - Cost Allocation in Fractional Jet Ownership Programs

Wenwei Cao, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, cww@gatech.edu, Ozlem Ergun, Lezhou Zhan, Ellis Johnson

Higher charter and reposition costs have plagued the profitability of the fractional jet industry since its inception. Incentive programs and pricing adjustments are introduced to offset these common costs incurred to service the customers. A central problem in designing these programs is establishing a justifiable cost allocation scheme. Furthermore, accurate estimates of cost-to-serve are valuable information to other marketing and operational decisions. In this paper we develop different mechanisms for the cost allocation problem. The appropriateness and key trade-offs of the mechanisms are also discussed on the basis of certain principles of equity and computational performance.

2 - An Integrated Optimal Decision Model for Ground Logistics and Air Cargo Scheduling

Kwon Gi Mun, PhD Student, Rutgers Business School, #1009B, 1 Washington Park, Newark, NJ, 07102, United States of America, kwongmun@eden.rutgers.edu

The mathematical model of two-tiered generalized scheduling problem has been formulated. Thus the optimal assignment solution between airports and facilities will be computed with the minimum transportation cost at the first stage. And then the minimum total cost will be calculated with the optimal routing solution of aircrafts. This research will use a mathematical model with practical constraints and real data.

■ SA62

62- Borein A - Hyatt

Joint Session Auctions/MSOM: Competitive Sourcing and Procurement

Cluster: Auctions & Manufacturing & Service Oper Mgmt

Invited Session

Chair: Cuihong Li, University of Connecticut, Storrs, CT, 06269, United States of America, cli@business.uconn.edu

1 - Incentive Functions for Transportation Procurement Auctions

Diwakar Gupta, University of Minnesota, 111 Church Street S. E., Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu, Justin Azadivar, Yibin Chen

State Transportation Agencies (STAs) use variants of the first-price sealed-bid auction mechanism to realize low cost, high quality, and fast completion of highway and bridge construction projects. STAs pay incentives based on the realized value of an attribute of the work, which may or may not be of value, but bids do not explicitly include this attribute. We present models to identify cost-minimizing incentive functions for agencies, net of any benefits that may accrue from the attribute.

2 - An Analysis of Scoring and Buyer-determined Procurement Auctions
Natalia Santamaría Tobar, Universidad de Los Andes, Departamento de Ingenierìa Industrial, Bogotá, Colombia, n-santam@uniandes.edu.co

I compare two procurement auction formats (in terms of the expected cost for the buyer) in which an incumbent competes with a group of entrants. A scoring auction in which suppliers compete on the adjusted bids or scores, and, a buyer-determined auction in which suppliers compete on the price, and the buyer adjusts the bids with the non-price attributes after the auction to determine the winner.

3 - Bidding Decisions under Costly Information Acquisition
Brendan See, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48104, United States of America, bdsee@umich.edu, Izak Duenyas, Damian Beil

Procurement research typically assumes that suppliers know their cost to produce an item. While this may be true for an incumbent supplier, an entrant supplier is usually less informed. We model this scenario and allow the entrant to learn additional information at a cost. The entrant can learn prior to the auction or delay learning and make a less-informed bid. We study the entrant's strategy and evaluate how the buyer can influence this strategy through subsidies and other methods.

4 - Mechanism for Robust Procurements
Yingqian Zhang, Assistant Professor, Erasmus University Rotterdam, Burg. Oudlaan 50, Rotterdam, 3062 PA, Netherlands, yqzhang@ese.eur.nl, Sicco Verwer

We model robust procurement as an optimization problem. We show this problem is NP-complete, and propose a backtracking algorithm to find the optimal solution. We propose a multi-stage mechanism that is truthful, efficient, and post-execution individually rational. In the experiments, we compare our mechanism with an iterated greedy mechanism that represents the current practice in public procurements, in terms of the expected social welfare and the expected payments of the auctioneer.

■ SA63

63- Borein B- Hyatt

Behavioral Perspective on Sales and Operations

Contributed Session

Chair: Fei Qin, PhD Candidate, University of Cincinnati, College of Business, 312 Carl H. Lindner Hall, Cincinnati, OH, 45221, United States of America, qinfi@mail.uc.edu

1 - An Experimental Investigation of Information Utilization in Newsvendor Decisions
M.Sinan Gonul, Assistant Professor, METU, Department of Business Administration, Middle East Technical University, Ankara, 06800, Turkey, msgonul@metu.edu.tr, Ayse Kocabiyikoglu, Itir Gogus

In the current study, we aimed to investigate the utilization of information in the decision making process within classical newsvendor setting. Through an experimental design, three different types of information (i.e. demand, price and cost) were systematically withheld/made available and the resultant purchase decisions were recorded via software specifically tailored for the purpose. Behavioral patterns are examined, findings are discussed and future research directions are given.

2 - On the Risk-attitude of Informed Newsvendors
Torsten Gully, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, torsten.gully@uni-koeln.de, Ulrich Thonemann

The behavior of Newsvendors has been extensively analyzed in the behavioral operations literature. In essentially all experiments actual order quantites deviate from the order quantity predicted by the classical Newsvendor model. We show that risk-attitudes influence the deviation if people can assess the involved risk. We formulate a model to explain the effect of risk-attitudes on Newsvendor behavior and report on the validation of our model through a controlled laboratory environment.

3 - The Strategic Advantage of Behavioral Targeting: How Firm Can Benefit from Personal Data?
Vincenzo Palermo, Georgia Institute of Technology, 800 West Peachtree St., College of Management, Atlanta, 30308, United States of America, vincenzo.palermo@mgt.gatech.edu, Dan Breznitz

We examine whether the access of personal data can create a competitive advantage for firms investing in behavioral targeting advertising. Specifically, we analyze a novel proprietary dataset on online investment strategies of 3,889 companies from 2006 to 2011. We identify three strategies: paid search, behavioral targeting and natural search. We show that an investment strategy based on personal data (behavioral targeting) is more effective than traditional advertising investment. Moreover, firms can experience positive synergies between behavioral and traditional investment strategies. Our results suggest that behavioral targeting lowers information asymmetries about consumers and therefore it increases advertising effectiveness. Despite its positive impact on firm performance, the use of personal data raises privacy concerns in that it is important to protect personal information without undermining the incentives to invest in online advertising.

4 - Vertically Restrictive Pricing Contracts for Bounded Rational Customers: Does Equity Matter?
Fei Qin, PhD Candidate, University of Cincinnati, College of Business, 312 Carl H. Lindner Hall, Cincinnati, OH, 45221, United States of America, qinfi@mail.uc.edu, Feng Mai, Amit Raturi, Michael Fry

In a single-period experiment, we test and compare Retailer Fixed Markup (RFM) policy with Price-only. Through the lenses of RFM contract, we investigate SC Power (high vs. low markup) and Pricing power (who is the pricing leader, the manufacturer or the retailer) to see how they would affect subjects' decision making process. We then attempt to update our analytical model to incorporate the findings from the experiment.

■ SA67

67- Ellis East- Hyatt

Data Fusion for Manufacturing System Performance Improvement I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jian Liu, Assistant Professor, The University of Arizona, Rm 221 ENGR Building, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, jianliu@sie.arizona.edu

Co-Chair: Ran Jin, Assistant Professor, Virginia Tech., 1145 Perry St., Blacksburg, VA, 24060, United States of America, jran5@vt.edu

1 - Calibration and Adjustment of Nanomaterials Property Prediction Model using Experiment Data
Chun Zhang, Georgia Institute of Technology, 755 Ferst Drive, NW, Atlanta, United States of America, czhang@fsu.edu, Ben Wang, Arda Vanli, Richard Liang, Kan Wang

Carbon nanotube sheet, i.e. buckypaper (BP), is a multifunctional nanomaterial with extraordinary properties. Post treatment using poly (vinyl alcohol) (PVA) can further enhance the mechanical properties of BP. A finite element based mechanical model was developed to link PVA-treated BP's modulus to its nanostructure characteristics. This model was then calibrated and adjusted using experimental data. The performance of the calibrated model was tested using the cross validation process.

2 - Computational Geometry and Data Fusion in CAD/CAM for Manufacturing System Performance Improvement
Yuan-Shin Lee, Professor, North Carolina State University, 400 Daniels Hall, Ind. Eng., CBox 7906, North Carolina State University, Raleigh, NC, 27695, United States of America, yslee@ncsu.edu

This paper presents methods of computational geometry and data fusion in CAD/CAM for manufacturing system performance improvement. Techniques of computational geometry processing and data fusion are presented for CAD/CAM decision optimization. Examples are provided on dealing with optimizing in CAD/CAM and CNC machining planes determination problems. The presented methods can be used to automate the traditional, experience-based tool selection tasks and to reduce the total machining time.

3 - Ensemble Modeling for Manufacturing Scale-up through Experimental and Observational Data Fusion
Ran Jin, Assistant Professor, Virginia Tech., 1145 Perry St., Blacksburg, VA, 24060, United States of America, jran5@vt.edu, Xinwei Deng

In modern manufacturing scale-up efforts, both experimental and observational data are available for material, process and quality. Current research efforts limited their scope on modeling quality-process relationship based on single type of data. This paper presents an innovative method to model the quality-process relationship by the fusion of the two types of data. An ensemble modeling strategy is developed, and case studies in both simulation and wafer manufacturing are provided.

4 - Detection of Approximate Periodicity in Categorical Time Series with Time Intervals

Jian Liu, Assistant Professor, The University of Arizona, Rm 221 ENGR Building, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, jianliu@sie.arizona.edu, Zhenrui Wang, Mingyang Li, Sean Dessureault

Categorical time series are symbol sequences arranged in the order of occurrence. When time of occurrences of symbols is also available, order and time information should be fused to detect periodic patterns. In practice, symbols often repeat with only approximately equal time intervals. This paper employs statistical method for the detection of such approximate periodicity. A case study from mining industry demonstrates the effectiveness of the proposed approach.

5 - Modeling, Experimental Design, and Analysis of Stereolithography Process for Direct 3-D Printing

Jizhe Zhang, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, jizhezha@usc.edu, Qiang Huang, Arman Sabbaghi, Tirthankar Dasgupta

We propose a systematic model to model and predict the shrinkage process to address the accuracy problem for Stereolithography (SLA, one technique for 3-D printing), instead of the traditional finite element simulation or experimental trial-and-error methods. A variant of Latin Square experimental design is employed to identify the process model and the experimental outcomes are analyzed for optimized compensation. One case study is presented to verify the shrinkage model and compensation.

■ SA68

68- Suite 312- Hyatt

Finance: Portfolio Analysis

Contributed Session

Chair: Ludovic Cales, HEC - University of Lausanne, Bat. Extranef, Room 253, Lausanne, 1015, Switzerland, ludovic.cales@unil.ch

1 - Absolute Return Portfolios

John Beasley, Brunel University & JB Consultants, United Kingdom, john.beasley@brunel.ac.uk

We consider the problem of deciding an absolute return portfolio, a portfolio of assets that is designed to deliver a constant return over time. We present a three-stage mixed-integer zero-one program for the problem that explicitly considers transaction costs associated with trading. We extend our approach to the problem of designing portfolios with differing characteristics. Computational results are given for portfolios derived from universes defined by S&P international equity indices.

2 - A New Approach to Asset Allocation: Constructing Portfolio Holdings Directly

Nan Xiong, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, nxiong@andrew.cmu.edu, Javier Peña, Burton Hollifield

In this paper, we propose a new approach to portfolio construction, which incorporates the estimation and optimization into a one-stage problem. We propose a new portfolio allocation strategy based on our one-stage formulation. We show that the resulting portfolio weights are less sensitive to the noisy data. Moreover, the proposed portfolio tends to perform better out-of-sample. The numerical results based on empirical and simulated data confirm our findings.

3 - Interactive Portfolio Optimization using Mean-Gini Criteria

Ran Ji, PhD Student, George Washington University, 2201 G St., Funger Hall 415H, Washington DC, DC, 20052, United States of America, jiran@gwu.edu, Miguel Lejeune, Srinivas Prasad

We propose a bi-objective Mean-Gini portfolio optimization model. An interactive solution procedure is designed to elicit preferences among the efficient portfolios. Computational results describing the convergence of the interactive procedure and the out-of-sample performance of the portfolios will be presented.

4 - A Bi-objective Portfolio Model for Supporting Services in a Hospital

Bartosz Sawik, PhD, Department of Applied Computer Science, Faculty of Management, AGH University of Science and Technology, Al. Mickiewicza 30, Krakow, 30059, Poland, B_Sawik@yahoo.com

This paper presents a bi-objective portfolio model for optimal allocation of supporting services in a hospital. The services include inventory, financial, operations management, etc. The optimality criteria of the problem are minimization of operational costs of supporting services subject to some specific constraints. The constraints represent specific conditions for resource allocation in a hospital. The computational experiments based on a real data from a hospital in Poland.

5 - A Rank-based Approach to Cross-sectional Analysis

Ludovic Cales, HEC-University of Lausanne, Bat. Extranef, Room 253, Lausanne, 1015, Switzerland, ludovic.cales@unil.ch, Monica Billio, Dominique Guègan

This paper studies the cross-sectional effects present in the market using a new graph theoretic framework. We model the evolution of a dynamic portfolio, i.e. a portfolio whose weights change over time, as a function of cross-sectional factors where the predictive ability of each factor is described by a variable. This modeling permits us to measure the marginal and joint effects of different cross-section factors on a given dynamic portfolio. Applications are presented.

■ SA69

69- Suite 314- Hyatt

Finance: Banking and Insurance

Contributed Session

Chair: Komlan Sedzro, Professor, School of Management, University of Quebec, 315 Ste Catherine Est, succ. Centre-Ville, Montreal, QC, H3C3P8, Canada, sedzro.k@uqam.ca

1 - Loan Rate Optimization for Financing Platforms

Wei Wang, IBM Research-China, Building 19 Zhongguancun Software Park, Haidian District, Beijing, 100193, China, Wangwcrl@cn.ibm.com, Yueting Chai, Hongwei Ding, Jin Dong

Financing platform is an important channel for small and medium enterprises (SME) to get loan supports. When receiving a loan request from a client, the financing platform needs to made decision on the loan rate. We build an optimization model for decision support. The objective is to maximize the profit and minimize the financing risks. A local-search based heuristics algorithm is designed to find the optimal solution; the simulation model is built to evaluate each option.

2 - B-spline Method of Estimating Term Structure of Interest Rate

Yifeng Yan, Xi'an Jiaotong University, No.2269 Mailbox, Xi'an, 710049, China, yanyifeng0123@163.com, Ju'e Guo

This study implements the B-spline method to estimate the term structure of interest rate using data in Shanghai stock exchange. It shows that the B-spline method has fine goodness of fitting.The B-spline method can be used as an effective tool of monitoring interest rate level and formulating monetary policies.

3 - The Informational Advantage of Local Investors: Evidence from Fund Managers Trades

Kian Ming Tan, Associate Lecturer, University of New South Wales, Kensington, Sydney, Australia, eric.tan@unsw.edu.au

The economic value of geography for money managers is now well supported in the literature by evidence of the profitability of local investments. Using data on both mutual fund equity holdings and fund returns, we find stocks with higher local investor participation to be associated with stocks abnormal returns during post event period. In addition, local ownership seems to predict funds increasing weighting on affected firms which experience lower credit risk.

4 - Finite Precision Errors in Stochastic Financial Networks

Ganesh Perumal, International Institute of Information Technology, 26/C Electronics City, Bangalore, India, ganesh_perumal@iiitb.ac.in, Abhilasha Aswal, G. N. Srinivasa Prasanna

A financial network of money transfers involving multiple currencies may be erroneous due to the usage of IEEE 754 binary standards. The fluctuations in currency exchange rates make this a random graph. In this presentation we show how to exploit such graphs to maximize cumulative errors in favour of some entity.

5 - Comparing the Performance of Microfinance Institutions in South America and Asia

Komlan Sedzro, Professor, School of Management, University of Quebec, 315 Ste Catherine Est, succ. Centre-Ville, Montréal, QC, H3C3P8, Canada, sedzro.k@uqam.ca, Marie-Héléne Noiseux

We apply multi-directional efficiency analysis to compare the performance of microfinance institutions (MFIs) in South America and Asia. Indeed, despite their supposedly importance in combating financial exclusion, many MFIs find it hard to attain financial independence. This fact in itself justifies the importance of studies on the performance of MFIs, especially interregional comparisons. The objective is to see if the MFIs in one region can copy the good practices of another geographic area.

■ SA70

70- Suite 316- Hyatt

Decision Making over Networks

Cluster: Computational Social Science

Invited Session

Chair: Azarakhsh Malekian, Massachusetts Institute of Technology, Cambridge, MA, United States of America, malekian@mit.edu

1 - Peers and Pundits: Correlated Opinion Dynamics

Mohamed Mostagir, Massachusetts Institute of Technology, 77 Massachusetts Ave., D32-632, Cambrdige, MA, 02139, United States of America, mosta@mit.edu, Daron Acemoglu, Asuman Ozdaglar

We study the simultaneous evolution of the opinion profile and network topology of a system of N agents. Agents are more inclined to communicate with those who hold similar opinions, but are also attracted to popular individuals. This system exhibits strong correlation over time and is difficult to analyze. Regardless, we show that it converges to a consensus, describe the role of popular agents, give bounds on the speed of convergence, and characterize that opinion for large societies.

2 - Striving for Social Status

Greg Stoddard, Northwestern University, 2133 Sheridan Road, Evanston, IL, 60208, United States of America, gregS@u.northwestern.edu, Rachel Kranton, Nicole Immorlica

We consider a network of agents producing a positional good; an agent's utility for the good is a function of both his intrinsic value for the good and his status, or production level relative to his neighbors. We show that the set of Nash equilibria of our game form a complete lattice. We then study the effects of status and network structure on society. We find that production increases and welfare decreases with status effects. Network structure can have arbitrary impacts on both quantities.

3 - Network Security and Contagion

Azarakhsh Malekian, Massachusetts Institute of Technology, Cambridge, MA, United States of America, malekian@mit.edu, Daron Acemoglu, Asuman Ozdaglar

We consider the network security problem and compare the properties of the equilibrium and the socially optimal solutions. An infection percolates over the network. Agents protect themselves by investing in the security. We delineate conditions under which there is underinvestment in the equilibrium and also show which sorts of networks lead to more severe market failures. When attacks are strategically targeted,we show that there is a new mechanism for overinvestment.

4 - Competitive Equilibrium in Two Sided Matching Markets with General Utility Functions

Saeed Alaei, University of Maryland, 4315 Rowalt Dr, APT 201, College Park, MD, 20740, United States of America, saeed.a@gmail.com, Azarakhsh Malekian, Kamal Jain

We present the first exact characterization of prices/payoffs at competitive equilibria in two sided matching markets with non-quasilinear utilities. The problem has been studied extensively (e.g. Demange, Gale, Quinzii, etc), however no constructive proof of existence and/or characterization was known for equilibria. We also derive a mechanism for Ad-Auctions which does not rely on the assumption that advertisers and search engine have the same belief about clickthrough rates.

■ SA71

71- Suite 318- Hyatt

Frontiers in Digital Business

Sponsor: eBusiness

Sponsored Session

Chair: Ali Tafti, University of Illinois at Urbana-Champaign, 1206 S. Sixth Street, 350 Wohlers Hall, Champaign, IL, 61820, United States of America, atafti@illinois.edu

1 - Effort and Quality in Online Crowdsourced Markets: Influence of Global Economic and Cultural Factors

Jesse Bockstedt, University of Arizona, 1130 E. Helen St., Tucson, AZ, 85721, United States of America, bockstedt@email.arizona.edu, Cheryl Druehl, Anant Mishra

One emerging consequence of crowdsourcing is increased competition in global labor markets for digital work. We analyze how economic and cultural factors influence the effort and quality of work contributed to these new virtual labor markets. Using data from a popular online logo design contest site we demonstrate that GDP per capita, broadband penetration, and Hofstede's cultural dimensions are strong predictors of a global digital worker's effort and work quality.

2 - Firm Capabilities, Entrepreneurial Behavior, and IT Sourcing

Ali Tafti, University of Illinois at Urbana-Champaign, 1206 S. Sixth Street, 350 Wohlers Hall, Champaign, IL, 61820, United States of America, atafti@illinois.edu, Ramanath Subramanyam, Rui Guo

We examine the relationship between firm capabilities and IT sourcing strategies, and the extent that this relationship is framed by specific entrepreneurial strategies.

3 - Can Social Come to the Rescue? Monetizing Music in the World of Free

Jui Ramaprasad, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3H2V1, Canada, jui.ramaprasad@mcgill.ca, Genevieve Bassellier, Remi Desmeules

We examine the role of social media enabled features and shared social responsibility (SSR) on willingness to pay (WTP) for online music. Through a survey-based experiment, we find that a user's WTP increases if an online music retailer incorporates the ability to build status and includes concepts of SSR in the distribution of revenues. This has implications for online music providers, artists, labels and the music industry as a whole, as well as other digital goods providers.

4 - A Theoretical Assessment of the Development and Success of Global Entrepreneurial Teams

Joy Oguntebi, Assistant Professor, Rochester Institute of Technology, 108 Lomb Memorial Dr., Rochester, NY, 14623, United States of America, joguntebi@saunders.rit.edu

The "globality" phenomenon has led to reduced national dominance and increased worldwide competition. As such, the growing ambitions of innovation-minded individuals and organizations in this new global market are capitalizing on the value of global entrepreneurial teams. Such teams are becoming more of a necessity as their diverse nature enables them to be more responsive to the external environment. This study investigates the formation and influence of global entrepreneurial teams.

■ SA72

72- Suite 322- Hyatt

Cloud Computing Research Trends

Cluster: Cloud Computing

Invited Session

Chair: Ilyas Iyoob, Director, Advanced Analytics, Gravitant - ChainOpt, 4507 A Dorsett Oaks Cir, Austin, TX, United States of America, ilyas.iyoob@chainopt.com

1 - Cloud Computing Research Survey – 2012 Update

Ilyas Iyoob, Director, Advanced Analytics, Gravitant-ChainOpt, 4507 A Dorsett Oaks Cir, Austin, TX, United States of America, ilyas.iyoob@chainopt.com

In this presentation, we provide an update of the current research in Cloud Computing, specifically the business of cloud. Previously we had compared cloud computing to a pull supply chain in an effort to organize the research domain. Continuing along the same lines, we show the progress of research over the past year. At the same time, we identify key shifts in the cloud computing industry and provide insights on how they may impact future research.

2 - Provisioning for Large Scale Loss Network Systems with Application in Cloud Computing

Yue Tan, The Ohio State University, 210 Baker Systems Bldg., 1971 Neil Ave., Columbus, OH, 43210, United States of America, tan.268@osu.edu, Yingdong Lu, Cathy Xia

We present a stochastic modeling approach to guide the resource provisioning task for future service clouds as the demand grows large. This problem can be mapped to a capacity planning problem in a general multi-class Erlang loss network model under quality of service constraint. We give an improved optimization formulation that is not only easier to solve, but also yields asymptotically exact provisioning solutions with improved QoS guarantees.

3 - Xpress-Mosel: Modeling Support for Distributed Computing in Physical and Virtual Networks

Oliver Bastert, FICO, Starly Way, Birmingham, United Kingdom, OliverBastert@fico.com, Susanne Heipcke

This talk presents the Xpress-Mosel environment and its functionality for distributed and remote modeling and solving of optimization problems. In particular, we describe new functionality for remote computing without any need for a local installation of Xpress that has recently been released. We discuss several examples of distributed applications implemented by some of our customers.

■ SA73

73- Suite 324- Hyatt

Economics

Contributed Session

Chair: Lorena Berumen, Professor, Universidad Panamericana, Augusto Rodin 498, Col. Insurgentes Mixcoac, Mexico, DF, 03920, Mexico, laberumen@up.edu.mx

1 - Estimating Real Money Balances for a Selected Asian Country: A Simultaneous Equation Model

Abul Jamal, Professor, Southeastern Louisiana University, College of Business, Hammond, LA, 70402, United States of America, ajamal@selu.edu, Yu Hsing

Equilibrium real balances and interest rates have been the subject of extensive research. Most studies presume the supply of money to be determined by the central bank and that the interest rate is only determined by the demand for money In this paper we use both the demand for and supply of money to estimate real money balances in a selected Asian country.

2 - The Volatility Characteristics of China's GEM Market and the Countermeasures

Jie Xiong, Xi'an Jiaotong University, Postbox 2230, School of Management, No.28 Xianning West Road, Shaanxi, Xi'an, China, xiongjie@stu.xjtu.edu.cn, Ju'e Guo, Dong Qian

Select the data of China's GEM index from June 1, 2010 to October 28, 2011. EMD method is used to analyze factors that influence the fluctuations of index. Three factors are found: trend, low-frequency component and high-frequency component. Than we use the AR-EGARCH-M model to analyze the dynamic relationship between the returns and volatility of the GEM market and give the corresponding countermeasures.

3 - The Role of Product Variety and Maturity in the Market Valuation of IT Intensive Firms

Wael Jabr, Assistant Professor, University of Calgary, 2500 University Dr NW, Calgary, AB, T3A6L5, Canada, wjabr@ucalgary.ca, Eric (Zhiqiang) Zheng

The pervasiveness and intensive use of Information Technology in every aspect of firm processes have enabled firms to maintain a portfolio of diverse products and allowed improved performance. In this study, we address the question of how companies should best manage their portfolio of IT products under disruptive environments. We hypothesize that diversity and maturity of products play an integral part in the firm's performance and its market value.

4 - A Panel Data Model to Explain Technical Change through IT in Latin America

Lorena Berumen, Professor, Universidad Panamericana, Augusto Rodin 498, Col. Insurgentes Mixcoac, Mexico, DF, 03920, Mexico, laberumen@up.edu.mx, Jen Ai de la Cruz, Gilberto González Pèrez, Margarita Hurtado, Irma Glinz

In this paper we evaluate the IT's impact over the conformation of the export profile of Argentina, Brazil and Mexico through a dynamic panel data model. We established that the adaptation and learning process is a function of expenditure on education and innovation, infrastructure and the dynamic of consumption.

Sunday, 11:00am - 12:30pm

■ SB01

01- West 101- CC

Genetic Algorithms and Ant Colonies

Contributed Session

Chair: Maria Woodside-Oriakhi, Assistant Professor, The College of the Bahamas, Oakes Field, Nassau, GT2602, Bahamas, moriakhi@cob.edu.bs

1 - Genetic Algorithm and New Heuristic in Block Relocation Problem - Fuel Reduction

Mazen Hussein, PhD Candidate, University of Wisconsin, Milwaukee, 1559 N. Prospect Ave., Apt # 305, Milwaukee, WI, 53202, United States of America, mhussein@uwm.edu, Matthew Petering

This research considers a variation of the block relocation problem (BRP). A set of identically-sized items is to be retrieved from stacks in a specific order using the minimum fuel consumption. In this work we consider container weight in fuel consumption calculations and explicitly tracking the containers moves. We developed a new heuristic that is embedded in a genetic algorithm. Results show that the methodology is effective in identifying near-optimal parameter settings.

2 - Evaluation of Multi-objective Genetic Algorithms on a Preventive Maintenance Scheduling Model

Kamran Moghaddam, Assistant Professor of Systems Engineering, Southern Polytechnic State University, 1100 South Marietta Parkway, Marietta, GA, 30060, United States of America, kmoghadd@spsu.edu

A multi-objective optimization model to find optimal preventive maintenance and replacement schedules of a multi-component system is used to evaluate performance of different multi-objective genetic algorithms. This multi-objective, nonlinear, mixed-integer model is an NP-hard optimization model that cannot be solved using exact algorithms. The different performance metrics are used to evaluating closeness and diversity of non-dominated solutions found by multi-objective genetic algorithms.

3 - Ant Colony Optimization for the Cardinality Constrained Portfolio Problem

Maria Woodside-Oriakhi, Assistant Professor, The College of the Bahamas, Oakes Field, Nassau, GT2602, Bahamas, moriakhi@cob.edu.bs

This paper extends the mean-variance model of Markowitz to include the cardinality constraints This limits the number of assets held in the portfolio and sets bounds on the proportion of an asset held. An ant colony optimization heuristic algorithm is presented using data from seven real world market indices.

■ SB02

02- West 102 A- CC

Joint Session: DAS/ENRE-Energy: Expert Elicitation of Energy Technologies: Theory and Practice

Sponsor: Decision Analysis & Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Erin Baker, University of Massachusetts, Amherst, MA, United States of America, edbaker@ecs.umass.edu

1 - Elicitations of Energy Penalties for Carbon Capture Technologies

Karen Jenni, Principal, Insight Decisions, LLC, 2200 Quitman St., Denver, CO, 80212, United States of America, kjenni@insightdecisions.com, Gregory Nemet, Erin Baker

We conducted elicitation interviews with 15 experts in carbon capture technologies, exploring the effects of different energy policies on the viability of and the energy penalties (EP) for 6 technologies, by 2025. Expert opinions varied substantially both within a specific technology and between technologies. A worldwide carbon pricing scenario leads to a decrease in the mean EP of 1% to 10% across the technologies; a scenario of increased US government R&D leads to a decrease of 6% to 14%.

2 - Online Expert Elicitation Tools: Development and Case Studies in Energy Technology Assessment

Steve Davis, Senior Research Associate, Carnegie Institution of Washington, 260 Panama Strett, Stanford, CA, 94305, United States of America, sjdavis@dge.stanford.edu, Karen Fries

We are developing innovative tools to facilitate online expert elicitation in order to reduce the time and resources required to characterize uncertainty and the sources/scope of disagreement among experts. Such characterization is critical to directing R&D efforts on technical topics. We focus on experts' subjective judgments on energy technologies. Here we demonstrate the tools under development and present results of testing with experts on solar PV and airborne wind energy systems.

3 - Uncertainty and Surprise in Energy Forecasts: The Cost of Photovoltaics

Max Henrion, CEO, Lumina Decision Systems, 26010 Highland Way, Los Gatos, CA, 95033-9758, United States of America, henrion@lumina.com, Evan Sherwin

Power system planners and other energy analysts would like to know the future performance and costs of renewable and fossil energy technologies. Several research groups have used expert elicitation to assess uncertainty using probability distributions for these quantities. We compare projections for photovoltaics. Recent dramatic and unexpected cost reductions suggest systematic overconfidence in expert assessments.

4 - Harmonization and Aggregation of Energy Technology Elicitations

Erin Baker, University of Massachusetts, Amherst, MA, United States of America, edbaker@ecs.umass.edu

There have been a number of expert elicitations performed on energy technologies recently, including 5 studies on solar and 7 on CCS. In this project we are attempting to harmonize and then aggregate the data from disparate studies. Harmonizing the data across the elicitations has a number of specific challenges, as surveys differ along several dimensions, including the metrics elicited, the timing, and the levels of R&D funding considered.

■ SB03

03- West 102 B- CC

Behavioral Decision Making

Sponsor: Decision Analysis

Sponsored Session

Chair: Manel Baucells, Rand Corporation and University Pompeu Fabra, 1776 Main Street, Santa Monica, CA, 90401, United States of America, manel.baucells@upf.edu

1 - Reference Price Comparison, Mental Accounting, and Anomalies in Consumption-Payment Decisions

Woonam Hwang, PhD Student, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, whwang.phd2009@london.edu, Manel Baucells

We propose a positive theory of consumer choice. When evaluating the hedonic benefits of consumption and payment decisions, consumers engage in a double comparison: one between the benefit of consumption and the reference price, and another between the reference price and the actual price. These comparisons are governed by proposed laws of mental accounting. Under standard assumptions, our model predicts various consumer choice anomalies such as sunk cost effects and the flat-rate bias.

2 - Felicity during Anticipation and Recall

Manel Baucells, Rand Corporation and University Pompeu Fabra, 1776 Main Street, Santa Monica, CA, 90401, United States of America, manel.baucells@upf.edu, Silvia Bellezza

We propose a set of psychologically plausible assumptions that yield the felicity, moment-utility, function of a given episode, including the anticipation and recall. The felicity function is U-shaped during anticipation. Shortening anticipation makes the event more surprising, and leads to an increase in utility from recall. The model has prescriptive recommendations to help cope for negative events. We provide empirical evidence in favor of the main implications of the model.

3 - Model-based Correction of Overprecision Bias in Subjective Confidence Intervals

Venkat Prava, Johns Hopkins University, 3400 N. Charles Street, 313 Ames Hall, Baltimore, MD, 21218, United States of America, avadhanulu@gmail.com, Robert Clemen, Benjamin Hobbs, Melissa A. Kenney

Elicited confidence intervals tend to be overly narrow. We propose a model to correct this bias based on the normal and bi-normal distributions. Model parameters are estimated by adjusting expert responses using a sufficient number of questions with known answers. We apply these models to datasets of expert elicitations, testing model validity with holdout analysis and quantile-quantile plots. The bi-normal model fits better, indicating an asymmetric overprecision bias.

■ SB04

04- West 102 C- CC

Uncovering Risk and Probabilities

Contributed Session

Chair: Saurabh Bansal, Assistant Professor, Pennsylvania State University, 405 Business Building, University Park, PA, United States of America, sub32@psu.edu

1 - Stakeholder Perspectives on Risk Scenarios for EMR Implementing

Chi-Chang Chang, Assistant Professor, Chung-Shan Medical University Hospital, 110, Sec. 1, Chien-Kuo N. Rd., Taichung, Taiwan-ROC, changintw@gmail.com, Yu-Hung Cheng

The purpose of this research is to elicit the risk scenarios and stakeholders' risk priority during EMR project implementing. We adopt the intuitionistic fuzzy theory for risk management. We conducted a field study for a medical center of middle Taiwan to comment the risk of identification, analyses, measurement and control, respectively. Based on the result of this study, we found that the risk measurement of the IFS be able to elicit the collective risk scenarios ranking of stakeholders.

2 - A New Method for Valuing Probability Assessment

Brad Powley, PhD Candidate, Stanford University, 475 Via Ortega, Stanford, CA, 94305, United States of America, bpowley@stanford.edu

A fundamental step in decision analysis is the encoding of probabilities. This paper introduces a method for valuing probability assessments on a continuous, uncertain quantity in a way that recognizes an expert's inconsistency and the cost of the assessment. I will demonstrate this method using the example of a pharmaceutical company's decision whether to market versus license a drug.

3 - Caveats of Decision Rules for Comparing Alternatives under Incomplete Preference Information

Antti Punkka, Systems Analysis Laboratory, Aalto University School of Science, Otakaari 1 M, Espoo, 02150, Finland, antti.punkka@aalto.fi, Ahti Salo

We show that the recommendations provided by several decision rules may depend on the normalization of the additive value function. This means, for instance, that these rules may exhibit rank reversals if the two consequences that are selected for normalizing the value function are replaced by other consequences. As a remedy, we propose the analysis of all rankings generated by those value functions that are consistent with the stated incomplete preference information.

4 - Profile-based Bayesian Method for Assessing Process Risk

Chang-Ho Chin, Associate Professor, Kyung Hee University, Department of Industrial and Management, Yongin-si, Korea, Republic of, chin@khu.ac.kr, Aida Mercado Hernandez

A process is a sequence of interdependent and linked activities to accomplish a predetermined goal. The early detection of process instances terminated without reaching the goal reduces the loss of resources. We propose a likelihood-based Byesian method to estimate the abnormal termination probability of process instances in real time. The estimated probability could be used as a precaution for the worst or a basis for go/no-go decision.

5 - Probability Elicitation in the Presence of Elicitation Errors

Saurabh Bansal, Assistant Professor, Pennsylvania State University, 405 Business Building, University Park, PA, United States of America, sub32@psu.edu, Genaro Gutierrez

We develop two analytical approaches to determine the parameters of a distribution using elicited fractile values in the presence of elicitation errors. Both approaches minimize the variance in the estimation error for the parameters of the distribution. We show that both these approaches should be preferred over approaches that ignore elicitation error and/or elicit only a specific set of fractiles.

■ SB05

05- West 103 A- CC

IIE Transactions

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jianjun (Jan) Shi, The Carolyn J. Stewart Chair and Professor, Georgia Institute of Technology, 765 Ferst Drive, Room 109, Atlanta, GA, 30332-0205, United States of America, jianjun.shi@isye.gatech.edu

1 - A Bayesian Framework for Online Parameter Estimation and Process Adjustment using Categorical Observations

Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Beijing, China, kbwang@tsinghua.edu.cn, Jing Lin

In certain manufacturing processes, low resolution categorical observations could be obtained as feasible and low-cost surrogates for accurate readings. In this work, a new online approach for parameter estimation and run-to-run process control using categorical observations is developed. The new approach is built in the Bayesian framework; it provides a convenient way to update parameter estimates when categorical observations arrive gradually in a real production scenario.

2 - Multiscale Monitoring of Autocorrelated Processes using Wavelets Analysis

Kamran Paynabar, University of Michigan, Ann Arbor, MI, United States of America, kamip@umich.edu, Judy Jin, Huairui Guo

This paper proposes a new method to develop multiscale monitoring control charts for an autocorrelated process that has an underlying unknown ARMA (2,1) structure. The Haar wavelet transform is used to obtain effective monitoring statistics by considering the process dynamic characteristics in both time and frequency domains. Through several simulation scenarios, we show that proposed control charts outperform other existing charts in terms of detecting changes in an autocorrelated process.

■ SB06

06- West 103 B- CC

Analysis of Steady-State Simulation Output Processes

Sponsor: Simulation

Sponsored Session

Chair: Emily Lada, Operations Research Specialist, SAS, SAS Campus Dr., Cary, NC, 27513, United States of America, Emily.Lada@sas.com

1 - Evaluation of Batched Quantile Estimation Methods

Dave Goldsman, Georgia Institute of Technology, School of ISYE, Atlanta, GA, 30332, United States of America, sman@gatech.edu, Christos Alexopoulos, James Wilson

We study the performance of asymptotically valid confidence intervals (CIs) methods for steady-state quantiles computed from nonoverlapping batches. Our results form the basis for the development of fully sequential procedures that yield CI estimators of steady-state quantiles with user-specified absolute or relative precision.

2 - Initialization of Finite-horizon Simulations

Peter Glynn, Professor, Stanford University, Huang Engineering Center, Stanford, CA, 94305, United States of America, glynn@stanford.edu, Eunji Lim

We introduce a new type of initialization problem that arises in real-time simulations. In such applications, the state needed to initialize the simulation is not completely observable, either because monitoring the physical system does not provide complete information or because the model includes artificial states that are not observable. We discuss the new initialization issues, make connections to the filtering literature, and present two algorithms to address these issues.

3 - The Simulation Start-up Problem: Performance Comparison of Recent Solution Procedures

James Wilson, Professor, Edward P. Fitts Department of Industrial Engineering, North Carolina State University, Raleigh, NC, 27695-7906, United States of America, jwilson@ncsu.edu, Anup Mokashi, Emily Lada

We summarize the results of a comprehensive experimental performance comparison of some recent procedures for solving the simulation start-up problem, including the methods incorporated in MSER-5, N-Skart, waSSP, and SBatch. Substantial differences in performance are observed, especially in comparisons of MSER-5 with the latter three procedures.

■ SB07

07- West 104 A- CC

INFORMS DM Student Paper Award Competition

Sponsor: Data Mining

Sponsored Session

Chair: Peter Qian, University of Wisconsin, Madison, WI, United States of America, peterq@stat.wisc.edu

1 - INFORMS Data Mining Best Student Paper Competition

Peter Qian, University of Wisconsin, Madison, WI, United States of America, peterq@stat.wisc.edu

Four selected finalists will present their papers in the INFORMS DM Best Student Paper competition. The winner will be announced at the INFORMS DM business meeting and all finalists will receive an award certificate.

■ SB08

08- West 104 B- CC

Joint Session Doing Good with Good OR/SPPSN: Doing Good with Good OR Competition: Finalist Presentations I

Cluster: Doing Good with Good OR Student Competition & Public Programs, Service and Needs

Invited Session

Chair: Sila Cetinkaya, Texas A&M University, College Station, TX, United States of America, sila@tamu.edu

1 - The Effect of Budgetary Restrictions on Breast Cancer Diagnostic Decisions

Mehmet Ayvaci, Assistant Professor, The University of Texas at Dallas, Jindal School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, ayvaci@wisc.edu, Elizabeth Burnside, Oguzhan Alagoz

We develop a finite-horizon constrained Markov Decision Process to model diagnostic decisions after mammography where we maximize the total expected quality adjusted life years (QALYs) of a patient under resource constraints. Comparing to actual clinical practice, using optimal thresholds may result in 22% cost savings without sacrificing QALYs. Our modeling framework could be used for evaluating cost-effectiveness of diagnostic procedures.

2 - Dynamic Monitoring of Chronic Disease

Jonathan Helm, Assistant Professor, Indiana University, Kelley School of Business, ODT, 1309 East Tenth Street, Bloomington, IN, 47405, United States of America, jhelm@umich.edu, Gregg Schell

This research develops new methods for dynamically monitoring chronic disease to allow better detection of disease worsening with fewer tests. We developed a prototype and tested it on a major clinical trial with results that significantly outperform current practice. Our team, including engineers, a clinician, and an epidemiologist, is working toward integrating our algorithms into widely used glaucoma testing machines.

3 - Optimal Distribution of Medical Backpacks and Health Surveillance Assistants in Malawi

Amber Kunkel, Rice University, 6100 Main Street, Houton, TX, 77005, United States of America, agkunkel@gmail.com, Elizabeth Van Itallie, Duo Wu

The Malawian people face severely limited healthcare access. To address this issue, we used large-scale p-median and capacitated facility location problems to create a scalable, three-tiered plan for optimal allocation of Health Surveillance Assistants (HSAs), HSA designated medical backpacks, and backpack resupply centers in Malawi. This plan will be used to direct the Beyond Traditional Borders' HSA backpack program scale-up.

■ SB09

09- West 105 A- CC

Neurophysiology and Decision Making

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Niklas Ravaja, Professor, Aalto University, School of Economics, P.O. Box 21255, Helsinki, 00076, Finland, ravaja@mappi.helsinki.fi

1 - Neurophysiological Methods in Decision Making Research

Niklas Ravaja, Professor, Aalto University, School of Economics, P.O. Box 21255, Helsinki, 00076, Finland, ravaja@mappi.helsinki.fi, Pekka Korhonen, Outi Somervuori, Jyrki Wallenius, Murat Koksalan

Neurophysiological or psychophysiological measures, such as electroencephalography (EEG), facial electromyography (EMG), electrocardiography (ECG), and electrodermal activity (EDA), have attained increasing attention in studying emotional and cognitive processes during decision making. This presentation will discuss the use of these measures. In addition, some recent decision making studies employing neurophysiological measures will be presented.

2 - Purchase Behavior and Psychophysiological Responses to Different Price Levels

Outi Somervuori, Aalto University School of Economics, 00076, Finland, outi.somervuori@aalto.fi, Niklas Ravaja

The aim of the study was to examine emotional processes in purchase decision. The participants were presented purchase decision trials with 14 different products whose price levels were changed while their facial electromyography (EMG) and electrodermal activity (EDA) were recorded. The results suggest that low prices and national brand products induce higher positive emotions compared to high prices and private label products. Also, positive emotions are related to greater purchase intent.

■ SB10

10- West 105 B- CC

A Robust Optimization Approach to Stochastic Analysis

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Nataly Youssef, Graduate Student, Massachusetts Institute of Technology, 143 Albany St., Apt. 014C, Cambridge, MA, 02139, United States of America, youssefn@mit.edu

1 - Robust Queueing Theory

Chaithanya Bandi, PhD Student, Massachusetts Institute of Technology, 02139, United States of America, cbandi@mit.edu, Nataly Youssef, Dimitris Bertsimas

We study queueing systems by employing robust optimization as opposed to stochastic analysis. We set the limiting laws of probability as the axioms of our approach and model queue primitives by uncertainty sets. We analyze single-class multi-server queueing networks and obtain closed form expressions for the waiting times with heavy-tailed arrival and service processes. Our approach yields accurate results compared to simulations and is fairly insensitive to network size and traffic intensity.

2 - Network Information Theory via Robust Optimization

Dimitris Bertsimas, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, dbertsim@mit.edu, Chaithanya Bandi

We provide via robust optimization (RO) inner and outer bounds for the capacity region of multi-user channels with interference for finite code length n and a code that matches the inner bound. As n increases,the bounds are tight and lead to an asymptotic characterization of the capacity region which is a well-known open problem. The RO problems take the form of rank minimization SDPs for Gaussian and MILPs for Exponential, Binary and Uniform channels. We report results for up to 200000 codewords.

3 - Pareto Efficiency in Robust Optimization

Nikos Trichakis, Assistant Professor, Harvard Business School, Boston, MA, United States of America, ntrichakis@hbs.edu, Dan Iancu

We argue that the classical robust optimization (RO) paradigm need not produce solutions that possess the (suitably adapted) property of Pareto optimality. We illustrate how this could lead to inefficiencies and suboptimal performance in practice. We introduce and provide a basic theoretical characterization of Pareto robustly optimal solutions. Numerical studies demonstrate that such solutions have significant upside compared with ones obtained via classical RO, at no extra cost or downside.

■ SB11

11- West 105 C- CC

Application of Stochastic Programming I

Contributed Session

Chair: Yang Tan, FedEx Services, 3640 Hacks Cross Rd., Memphis, TN, 38125, United States of America, ytan0920@gmail.com

1 - A Scenario Generation-based Lower Bounding Approach for Stochastic Scheduling Problems

Lingrui Liao, Google Inc., 1550 Technology Dr., Unit 3085, San Jose, Ca, 95110, United States of America, lingrui@gmail.com, Hanif D. Sherali, Subhash C. Sarin

We investigate scenario generation methods to establish lower bounds on the optimal objective value of stochastic scheduling problems. In contrast to the Sample Average Approximation approach, we use the idea of recursive stratified sampling to develop a discrete bounding method. Exact lower bounds for expectation and conditional value-at-risk objectives are developed, and are demonstrated using a single machine total weighted tardiness problem with experimental results.

2 - A Stochastic Programming Approach for Decision-dependent Uncertainty in Production Planning

Alwin Haensel, Université Paris Sud, Bât 650 Université Paris-Sud 11, Orsay, 91405, France, haensel.alwin@gmail.com, Marco Laumanns

Regulation pressure on production quality and standards is increasing. A production plan needs to consider risks of failing the inspections, whose realizations dependents on the production schedule. This dependency increases the complexity significantly. The uncertain inspection realizations are modeled by scenarios generated from given product-site hazards. We propose a general scenario based stochastic programming approach to compute solutions for risk-neutral and risk-averse decision makers.

3 - Stochastic Approach for Resource Allocation and Facility Utilization

Anirudha Kulkarni, Graduate Research Assistant, Rochester Institiute of Technology, Rochester, Rochester, NY, 14623, United States of America, apk2932@rit.edu, Scott Grasman, Shrikant Jarugumilli

We formulate a stochastic resource allocation model that considers fluctuating demand over a long planning horizon. The stochastic program includes hiring, firing, overtime, shift-swapping and cross training. The rationale behind this is to reduce gaps in assignments and ensure efficient resource utilization. Results include discussion of the recourse, value of the stochastic solution, and implementation.

4 - Stochastic Lot-Sizing Model for Deteriorating Items under Partial Backlogging

Yang Tan, FedEx Services, 3640 Hacks Cross Rd., Memphis, TN, 38125, United States of America, ytan0920@gmail.com

This research is distinguished from most literature by considering the effects of deterioration and partial backlogging under stochastic customer demand. The optimal conditions under which a (s, S) policy holds are successfully derived and the explicit order quantities are obtained by reformulating the problem as a stochastic programming model.

5 - Linear Profile Monitoring

Azadeh Adibi, Arizona State University, 1265 E. University Dr, Tempe, AZ, United States of America

In this study,a method is proposed for phase 2 monitoring of linear profiles. Also, performance of the proposed method is compared with an existing method based on average run length criterion under different shifts in the model parameters.

■ SB12

12- West 106 A- CC

Structure of Convex Integer Programs

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Marco Molinaro, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States of America, molinaro@cmu.edu

1 - Closedness of Mixed Integer Hulls of Second Order Conic Programming Problems

Diego Moran, Georgia Tech, 755 Ferst Drive NW, Room 422, Main building, Atlanta, GA, 30332, United States of America, dmoran@gatech.edu, Santanu Dey

Given rational matrices A, B and vector b, we show that there exists a polynomial time algorithm to check the closedness of the convex hull of the set $\{(x,y)|Ax +By -b \in L, x integral\}$, where L is the Lorentz cone. Moreover, in the special case of pure integer problems, we present sufficient conditions for verifying the closedness of the integer hull of the feasible region of a more general second order conic programming problem (SOCP) that can also be checked in polynomial time.

2 - Disjunctive Cuts for Convex Mixed Integer Nonlinear Programs (MINLP)s and Extended Formulations

Mustafa Kilinc, Postdoctoral Researcher, University of Pittsburgh, 3700 O'Hara Street, Pittsburgh, United States of America, mrk46@pitt.edu, Sina Modaresi, Jeff Linderoth, James Luedtke, Juan Pablo Vielma

In this work, we study positive effects of extended formulations on generating cutting planes for convex MINLPs. First, stronger cuts can be generated in an extended formulation. Second, the performance of a pure LP-based cut generation method can be improved via extended formulations.

3 - On the Relative Strength of Different Generalizations of Split Cuts

Marco Molinaro, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, United States of America, molinaro@cmu.edu, Sanjeeb Dash, Oktay Gunluk

In this paper we show the complete relationship between the split, cross, crooked cross and t-branch split closures. We also study the strength of cross cuts from basic and 2-row relaxations. This answers three open questions left open by Day, Dash and Gunluk (2010).

4 - Lower-bound Analyses of the Lift-and-Project Ranks of Graph-based Polytopes

Yu Hin Au, PhD Candidate, University of Waterloo, 200 University Ave., W., Waterloo, ON, N2L3G1, Canada, yau@uwaterloo.ca

We'll discuss some ongoing work on obtaining inapproximability results for Bienstock-Zuckerberg and Lasserre lift-and-project algorithms on graph-based optimization problems. This is joint work with Levent Tuncel.

■ SB13

13- West 106 B- CC

Computational Issues on Solving Mixed Integer Second Order Cone Optimization Problems

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Julio Cesar Goez, PhD Candidate, Lehigh University, 18015, United States of America, jgoez1@gmail.com

1 - Computational Effectiveness of Split Cuts for Second-order Conic Programming

Sina Modaresi, University of Pittsburgh, 3700 O'Hara Street, Pittsburgh, United States of America, sim23@pitt.edu, Mustafa Kilinc, Juan Pablo Vielma

Split cuts are one of the most effective cuts for linear MIPs and they are equivalent to MIR cuts. We show that this equivalency does not hold for second-order conic MIPs by giving examples where split cuts strictly dominate conic MIR cuts proposed by Atamturk et al.. However, split cuts have to be added as nonlinear inequalities, while conic MIR cuts can be added as linear inequalities to the extended formulation. We compare the trade-off between the speed and the strength of these cuts.

2 - Branch and Bound for Mixed Integer Second Order Cone Optimization: Impact of Disjunctive Conic Cuts

Julio Cesar Goez, PhD. Candidate, Lehigh University, 18015, United States of America, jgoez1@gmail.com, Pietro Belotti, Ted Ralphs, Tamás Terlaky, Imre Polik

We investigate the use of Disjunctive Conic Cuts (DCC) in a Branch and Cut framework when solving MISOCO problems. Various criteria are explored to select the disjunctions to build DCCs at different nodes of the tree. Additionally, we explore different criteria for node selection and branching rules. These experiments will help us to understand the impact that DCCs have in decreasing the size of the search tree and the solution time.

3 - Restrict-and-Relax Search for 0-1 Integer Programs

Menal Guzelsoy, SAS, 100 SAS Campus Drive, Cary, NC, 7513, United States of America, menal.guzelsoy@sas.com, George Nemhauser, Martin Savelsbergh

We introduce restrict-and-relax search, an algorithm for 0-1 integer programs that explores a dynamic search tree by not only fixing variables (restricting), but by also unfixing previously fixed variables (relaxing). Starting by solving a restricted integer program, we may at any tree node selectively relax/restrict variables using dual/structural information. A proof-of-concept computational study demonstrates the effectiveness of the algorithm.

4 - A Regularized Interior-Point Method for Semidefinite Programming

Ahad Dehghani, McGill University, Montreal, Canada, ahad.dehghani@mcgill.ca, Jean-Louis Goffin, Dominique Orban

Interior-point methods in semi-definite programming (SDP) require the solution of a sequence of linear systems which are used to derive the search directions. Safeguards are typically required in order to handle rank-deficient Jacobians and free variables. We propose a primal-dual regularization to the original SDP and show that it is possible to recover an optimal solution of the original SDP via inaccurate solves of a sequence of regularized SDPs for both the NT and dual HKM directions.

■ SB14

14- West 106 C- CC

Uncertainty in Project Management

Contributed Session

Chair: Bajis Dodin, Professor, University of California, School of Business Administration, Riverside, CA, 92521, United States of America, bajis.dodin@ucr.edu

1 - Enumerating Feasible Task Sets with Ordered, Unmeasured Material Constraints

Jordan Srour, Assistant Professor, Lebanese American University, P.O. Box 13-5053, Beirut, Lebanon, fjsrour@gmail.com, Walid Nasrallah

We investigate the solution space for selecting a subset of project tasks under a resource shortage. The amount of resource required by each task is not known, but the tasks are fully ordered accordingly. We enumerate the ways to select a subset of tasks without exceeding the resource constraint. We highlight the relationship of this enumeration to published number sequences arising from regular Boolean functions. We provide both an enumeration algorithm and enumerations up to n=10.

2 - Stochastic Approach for Project Scheduling Based on Fund Availability

Yuvraj Gajpal, Assistant Professor, King Fahd University of Petroleum and Minerals, KFUPM Box 634, Dhahran, Saudi Arabia, gajpaly@gmail.com, Ashraf Elazouni

The paper considers a finance based project where the contractors finance projects mainly through the owners' progress payments supplemented by fund procured through establishing credit-line accounts. In this situation the best proactive approach for contractor is to schedule construction activities based on the available finance. A stochastic heuristic approach is proposed to device finance-based schedules of multiple projects.

3 - A Nonlinear Programming Model for Stochastic Project Crashing

Ronald Davis, Associate Professor, San Jose State University, College of Business, One Washington Square, San Jose, CA, 95192, United States of America, ronald.davis@sjsu.edu

When beta distributions are used for every activity early start and finish time distribution in a project network, moment preserving beta approximations for the sum and product of beta cdfs can be coded in VBA to allow an analytic stochastic forward pass to be carried out, without simulation. Introduction of crashing variables and costs yields a nonlinear programming formulation to minimize crash cost subject to a constraint on mean project duration. Realistic example SOLVER results are shown.

4 - Portfolio Management in a Highly Uncertain Environment: The Role of Interdependencies

Olga Kokshagina, PhD Student, Centre for Scientific Management (CGS), CGS Mines ParisTech, 60 Boulevard Saint-Michel, Paris, 75272, France, olga.kokshagina@mines-paristech.fr, Patrick Cogez, Pascal Le Masson, Benoit Weil

This work deals with portfolio management strategies in high uncertainty. There exist strategies that consider projects separately or dependently. Literature shows first, the dependencies have a tendency to increase complexity and cost of the system. Second, there is a possibility to share risks in between projects, to highlight the effect of learning. Our paper investigates the contradictory role of interdependencies and the relevant management strategies in particular industrial situations.

5 - Scheduling & Financial Planning in Probabilistic Projects

Bajis Dodin, Professor, University of California, School of Business Administration, Riverside, CA, 92521, United States of America, bajis.dodin@ucr.edu, Abdelghani Elimam

In probabilistic projects (PP) required duration and resources for some or all activities are given as random variables characterized by their own probability distribution functions (PDFs). Managing a PP requires dealing with several important issues. In this paper, we analyze the impact of the various stochastic variations on the duration, and cost of the project. Procedures for determining the PDFs of project cost and duration, and project schedule are developed.

■ SB15

15- West 202- CC

Software Demonstration

Invited Session

1 - Ziena Optimization LLC - New Developments in the KNITRO Optimization Solver

Richard Waltz, President, Ziena Optimization LLC, 1801 Maple Avenue, Ste. 6305, Evanston, IL, 60201 United States of America, waltz@ziena.com

This software demonstration will highlight the latest developments and improvements in the KNITRO optimization solver. Benchmark results will be provided for various problem classes. The demo will also provide an overview of how to effectively use KNITRO in a variety of environments and interfaces.

2 - Artelys - Optimizing Military Attacks on Multi-Commodity Supply Chain Networks: a Min-Max Problem Solved with Artelys Kalis

Sylvain Mouret, Product Manager, Artelys Kalis, 150 N. Michigan Avenue, Ste. 800, Chicago IL, 60601, United States of America, ain.mouret@artelys.com

Learn how easy it is to solve general min-max problems arising in adversarial games with Artelys Kalis. Thanks to its hybrid CP/MIP architecture, it is possible to build an efficient branch and bound method specialized for such problems in just a few lines of code. We will demonstrate how Kalis has been embedded in a full-range operational solution based on the Artelys Network Designer GIS visualization platform. This solution is currently used to study supply chain network vulnerabilities with respect to military attacks.

■ SB16

16- West 207- CC

Multi-agent Scheduling Problems

Cluster: Tutorials

Invited Session

Chair: Alessandro Agnetis, Professor, Universita di Siena, Dipartimento Ingegneria Informazione, via Roma 56, Siena, 53034, Italy, agnetis@dii.unisi.it

1 - Multi-agent Scheduling Problems – Scheduling Problems

Alessandro Agnetis, Professor, Universita di Siena, Dipartimento Ingegneria Informazione, via Roma 56, Siena, 53034, Italy, agnetis@dii.unisi.it

In Multi-Agent Scheduling problems, a number of distinct agents, each owning a subset of all jobs, share common processing resources. The analysis in this case focuses on finding efficient and, possibly, fair solutions. After presenting some motivation, we review basic issues, illustrate the main complexity results, discuss related problems and point out future research needs.

■ SB17

17- West 208 B- CC

SpORts I

Sponsor: SpORts

Sponsored Session

Chair: Dan Finkel, Technical Staff, Massachusetts Insitute of Technology, Lincoln Laboratory, 244 Wood Street, Lexington, MA, 02420, United States of America, dfinkel@ll.mit.edu

1 - Serving Strategy in Tennis

Yigal Gerchak, Professor, Tel Aviv University, Ramat Aviv 69978, Israel, yigal@post.tau.ac.il, Marc Kilgour

Common practice in Tennis is to hit a powerful first serve. Should it fault, the second serve is usually much weaker. Recently it has been argued that this strategy is flawed - both serves should be powerful. According to our analysis, however, the current practice of a weaker second serve appears to be roughly optimal.

2 - On the (Non-Linear) Probability of Winning a (College) Football Game

Eric Huggins, Associate Professor of Management, Fort Lewis College, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

In this paper, we estimate the probability that a football team wins a game based on the point spread and the over/under. This work is an extension of the Hal Stern's 1991 paper with several key differences: 1) We analyze data for both college and professional football, using a much larger data set. 2) We factor in the over/under as well as the point spread. 3) We explore several non-linear models for the probability function.

3 - In-play Football Prediction

Nils Rudi, Professor of Technology and Operations Management, INSEAD, 1 Ayer Rajah Ave., Singapore, 138676, Singapore, Nils.RUDI@insead.edu, Harry Groenevelt, Bhavani Shanker Uppari

We model the scoring of two football teams as two Poisson processes. For a given pre-game predictive distribution, we show that there exists a unique pair of arrival rates, which facilitate in-play prediction as function of time and score. This result is extended to time and score dependent arrival rates, and comparisons with Logistic regression is provided. We test the models on an extensive data set from major European football leagues.

■ SB18

18- West 208 A- CC

Applications of Network Optimization

Contributed Session

Chair: Alireza Kabirian, Assistant Professor, California State University Northridge, 18111 Nordhoff St, Northridge, CA, 91330, United States of America, akabirian@csun.edu

1 - Work Scheduling for Logistics Network

Dening Peng, PhD Candidate, Arizona State University, 1440 E. Broadway Rd., Tempe, AZ, 85282, United States of America, dening.peng@asu.edu, Pitu Mirchandani

A network optimization model is built for work scheduling on a logistics network, that exploits features of minimum-cost-flow and scheduling models. Flows on a certain link can exceed the link capacity but will incur a flow cost that is much higher than regular flow cost. The objective of the problem is to maintain (or repair or expand) links within a given time horizon, while minimizing the total maintenance and flow costs. Experiments are reported on several test networks.

2 - Transmission Network Expansion Planning under Demand Uncertainty and Risk Aversion

Joao Claro, INESC Porto, Campus da FEUP, Rua Dr. Roberto Frias, 378, Porto, 4200-465, Portugal, jclaro@fe.up.pt, Daniel Delgado

Explicit incorporation of uncertainty in transmission network design can help improve the balance between important concerns such as network utilization, demand satisfaction, or dynamic sourcing. We present a mean-risk mixed integer linear programming model for transmission network expansion planning, and use it to search for network design insights, with a study of loss-averse design of three fundamental network building blocks - an independent design, a radial design, and a meshed design.

3 - Modeling Wildfire Propagation using Stochastic Shortest Path

Mohammad Hajian, PhD, Northeastern University, 39 Orient Street, Malden, MA, 02148, United States of America, mohammad.hajian@gmail.com, Emanuel Melachrinoudis

In this paper, a stochastic shortest path algorithm is used to model the fire propagation on a landscape. The fire landscape is modeled as a network by using Delaunay triangulation. The time of fire traversal along each edge of the network is considered to be stochastic, depending on factors such as wind speed and direction, terrain, and weather conditions. The shortest path algorithm is used to find the probability distribution of fire arrival at a point of interest.

4 - Role of Information Sharing in Interdependent Dynamic Infrastructure Networks

Burak Cavdaroglu, Rensselaer Polytechnic Institute, 110 8th Street, CII Building Suite 5015, Troy, NY, 12180, United States of America, cavdab@rpi.edu, William Alan Wallace

In case of disruptions in civil infrastructure networks, a timely restoration of these networks is achieved with an effective selection and scheduling of the network components to be restored. In today's society, an infrastructure's restoration plan has a greater impact on another's due to the increasing amount of interdependencies among them. Using data representing the infrastructures of New Hanover County, NC, we depicted the impact of sharing the restoration plans among the infrastructures.

5 - Expansion Planning of Natural Gas Pipeline Networks

Alireza Kabirian, Assistant Professor, California State University Northridge, 18111 Nordhoff St., Northridge, CA, 91330, United States of America, akabirian@csun.edu

We develop optimization models for expansion planning of an existing natural gas pipeline network over a long run horizon. The model is to mainly find where new pipelines and compressor stations of the network must be installed to minimize the net present worth of capital investments and operating expenses. We also develop an evolutionary solution algorithm to solve the model. Numerical results will be presented at the end showing how the model and the solution algorithm are applied.

■ SB19

19- West 211 A- CC

Joint Session Healthcare Logistics/SPPSN: Routing Problems in Healthcare Operations I

Cluster: Healthcare Logistics & Public Programs, Service and Needs

Invited Session

Chair: Burcu Keskin, University of Alabama, Alston Hall, Box: 870226, Tuscaloosa, AL, 3587-0226, United States of America, bkeskin@cba.ua.edu

1 - A Sequential GRASP for the Therapist Routing and Scheduling Problem

Yufen Shao, Research Engineer, ExxonMobil Upstream Research Company, 3120 Buffalo Speedway, Houston, TX, 77098, United States of America, yufen.shao@exxonmobil.com, Ahmad Jarrah, Jonathan Bard

This talk presents a sequential GRASP for solving a weekly routing and scheduling problem for therapists. The problem contains both fixed and flexible patients with respect to appointment times, and two grades of therapists. In Phase I, feasible solutions are constructed one therapist and one day at a time. In Phase II, a high-level neighborhood search is proposed to obtain local optima. Performance is demonstrated using real and randomly generated data sets.

2 - An Optimisation Model for Staff Planning in a Home Care Organization

Pablo Andres Maya Duque, PhD, University of Antwerp/ Universidad de Antioquia, Ottoveniusstrat 26, box 6, Antwerp, 2000, Belgium, pmayaduque@gmail.com, Peter Goos, Kenneth Sörensen, Marco Castro

In this talk, we present the core optimization component of a decision support system that Landelijke Thuiszorg, a non-profit organization that provides home care services for several provinces in Belgium, will implement in order to assist the regional service planning. The optimization model takes into account assignment, scheduling and routing decisions simultaneously, while considering two objectives, namely the service level and the travelled distance.

3 - Incorporating Patient, Nurse, and Agency Considerations in Home Health Care Routing

Ashlea Bennett Milburn, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, United States of America, ashlea@uark.edu, Jessica Spicer

Home health routing and scheduling problems can be modeled as multi-objective optimization problems, as home health agencies are often interested in creating nurse routes that achieve a variety of goals. We use a multi-objective tabu search heuristic to study the relationship among travel cost, nurse consistency (a measure of patient satisfaction), and balanced workload (an indicator of nurse satisfaction) objectives. Computational results for a number of realistic scenarios are presented.

4 - A Multi-period Home Care Scheduling Problem with Work Balance

Burcu Keskin, University of Alabama, Alston Hall, Box: 870226, Tuscaloosa, AL, 3587-0226, United States of America, bkeskin@cba.ua.edu, Shirley (Rong) Li, Charles Schmidt

We consider a home health care scheduling problem for a local hospital with multiple types of caregivers. We determine the assignment of caregivers to the patients visited at their homes so that the total routing costs are minimized and the workload of caregivers are balanced over a planning horizon while satisfying synchronization, precedence, loyalty, and other practical constraints. We present a MILP formulation and a branch-and-price solution approach based on Dantzig-Wolfe decomposition.

■ SB20

20- West 211B- CC

Software Demonstration

Invited Session

1 - American Optimal Decisions - Portfolio Safeguard (PSG): Advanced Nonlinear Mixed-Integer Optimization Package

Stan Uryasev,American Optimal Decisions, 5214 SW 91 Way, Ste. #130, Gainesville FL 32608, United States of America, uryasev@aorda.com

Portfolio Safeguard is an advanced nonlinear mixed-integer optimization package used in risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (maximum, StDev, variance, probability, VaR, CVaR, cardinality, fixed-charge, recourse etc.). See real-life case studies in Windows and MATLAB at www.aorda.com/aod/psg.action.

■ SB21

21- West 212 A- CC

Advances in Networks and Graphs

Contributed Session

Chair: Sivan Altinakar, École Polytechnique de Montréal, C.P. 6079, Succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, sivan.altinakar@gerad.ca

1 - Approximating Precedence Network Structure with Incomplete Information

Adam Graunke, The Boeing Company, P.O. Box 3707, MC 13-98, Seattle, WA, 98124, United States of America, adam.a.graunke@boeing.com, Gabriel Burnett

Accurate precedence networks are highly useful for planning and analysis, yet in large scale production systems, they are difficult, if not impossible, to define. In this research we investigate precedence networks in the presence of incomplete precedence information, with the goal of estimating production-critical properties of the network. Specifically, we investigate critical path analyses and the level of confidence associated with the results.

2 - Shortest Path with Secure Multipary Computation

Abdelrahaman Aly, Universite Catholique de Louvain, 34, Voie du Roman Pays, Louvain-la-Neuve, 1348, Belgium, abdelrahaman.aly@uclouvain.be, Mathieu Van Vyve

In various applications, i.e. elections, auctions, the computation of a global optimum requires input data from competing parties. A trusted third party to perform these computations is not guaranteed. Secure Multiparty Computation (SMC) is an encryption method which does not rely on such third party. The present research expands SMC's scenario to Shortest Path problem. We describe SMC variants of Bellman-Ford and Dijkstra algorithms and compare their performance with the traditional variants.

3 - Reconstruction of Three Dimensional Objects from Three Orthogonal Cartesian Bi-plane Projections

Siddhartha Sampath, Arizona State University, 849 W Elna Rae, Tempe, AZ, United States of America, Siddhartha.Sampath@asu.edu, Pavithra Ramamoorthy, Pitu Mirchandani

This application describes a network flow model for reconstructing the three-dimensional shape of a three dimensional object from biplane x-ray readings for all three orthogonal Cartesian planes.Each two-dimensional cross-section consists of one region or view of the object whose image is to be reconstructed.We can use apriori information to constrain the number of solutions, and then to obtain most likely reconstruction.

4 - Breaking Symmetry in Consecutive Edge-coloring

Sivan Altinakar, École Polytechnique de Montreal, C.P. 6079, Succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, sivan.altinakar@gerad.ca, Alain Hertz, Gilles Caporossi

Consecutive edge-coloring, a special case of edge-coloring in graph theory, aims to minimize the sum of the span of colors (integers) incident to each node. This has applications in scheduling. It is also NP-hard, and may be difficult to solve exactly even for a very small number of vertices. We compare different modeling approaches in Mixed Integer Programming and Constraint Programming, with an emphasis on the latter, and subsets of Lex-Leader constraints for efficient symmetry breaking.

■ SB22

22- West 212 B- CC

COIN-OR Multi-Threading Software

Sponsor: Computing Society

Sponsored Session

Chair: Bradley Bell, Senior Research Scientist/Enginer, University of Washington, IHME, 2301 Fifth Ave., Suite 600, Seattle, WA, 98121, United States of America, bradbell@seanet.com

1 - Could We Use a Million Cores to Solve a Single Integer Program?

Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Thorsten Koch, Yuji Shinano

Given the steady increase in cores per CPU, it is only a matter of time before supercomputers will have a million or more cores. In this talk, we investigate the opportunities and challenges that will arise when trying to utilize the distributed multi-core architectures that have recently become pervasive to solve a single integer linear optimization problem. We raise the question whether best practices in sequential solution of ILPs will be effective in massively parallel environments.

2 - A Multi-core Benchmark used to Improve Algorithmic Differentiation

Bradley Bell, Senior Research Scientist/Enginer, University of Washington, IHME, 2301 Fifth Ave., Suite 600, Seattle, WA, 98121, United States of America, bradbell@seanet.com

We present an application of Newton's method that finds all the zeros of a non-linear function in an interval. This is being used as a benchmark to improve the multi-core performance of the COIN-OR open source AD software package CppAD. Different threading systems, and different versions of this software package, are easily compared for speed of execution. As an example of the use of this benchmark, we compare the results for three versions of the software package.

3 - Parallelization of a Primal-dual IPM for SDP using OpenMP

Brian Borchers, New Mexico Tech, Mathematics Department, 801 Leroy Place, Socorro, NM, 87801, United States of America, borchers@nmt.edu

CSDP is software package for semidefinite programming that uses a primal-dual interior point method. We discuss how the software was parallelized using OpenMP, and discuss the parallel performance of the algorithm on problems of varying size.

4 - Application of SIMD Instructions in Solving Random 3-dimensional Assignment Problems

Mohammad Mirghorbani, The University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, seyedmohamma-mirghorbaninokandeh@uiowa.edu, Pavlo Krokhmal

We show how SIMD instructions can be utilized to vectorize an existing branch and bound method, BitCLQ, designed to enumerate k-cliques in special k-partite graphs. The k-cliques found map to guaranteed high-quality solutions of random 3-dimensional assignment problems. We observed up to 100% improvement in the performance of BitCLQ on the same machine after vectorization.

■ SB23

23- West 212 C- CC

Edelman 2012 Finalists II

Sponsor: CPMS, The Practice Section

Sponsored Session

Chair: Stephen Graves, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, sgraves@MIT.EDU

1 - Carlson Rezidor Hotel Group Maximizes Revenue with Improved Demand Management and Price Optimization

Pelin Pekgun, Assistant Professor, University of South Carolina, Moore School of Business, 1705 College Street, Columbia, SC, 29208, United States of America, Pelin.Pekgun@moore.sc.edu, Suresh Acharya, Kathleen Mallery, Kyle Christianson, Ronald Menich, Phillip Finch, Frederic Deschamps, James Van Sistine, James Fuller

Carlson Rezidor Hotel Group collaborated with JDA Software Group on a highly innovative revenue optimization project that started with enterprise demand forecasting in 2007. It was followed by a large-scale network optimization solution to dynamically optimize stay night rates based on price elasticity, competitor rates, remaining inventory, demand forecast and business rules. Compliant hotels consistently showed a 2-4% revenue improvement,and increased revenue by more than $16 million annually.

2 - Optimizing Capital Investment Decisions at Intel Corporation

Feryal Erhun, Stanford University, Stanford, CA, United States of America, ferhun@stanford.edu, Karl Kempf, Erik Hertzler, Timothy Rosenberg, Chen Peng

Intel spends over $5B annually on manufacturing equipment. With increasing lead times from equipment suppliers and increasing difficulty in forecasting market demand, optimizing capital investment decisions is a significant managerial challenge. We describe the Velocity Program and the DMEP framework, which have benefited Intel hundreds of millions of dollars in documented cost savings and at least $2B in revenue upside for a manufacturing process transition during a period of economic crisis.

■ SB24

24- West 213 A- CC

Joint Session HAS/SPPSN: Pandemic Modeling and Planning

Sponsor: Health Applications Society & Public Programs, Service and Needs

Sponsored Session

Chair: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, On, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - Quantifying the Value of Information for Inferring Contagion Patterns in Social Activity Graphs

Lauren Gardner, Lecturer, University of New South Wales, UNSW, Sydney, 2052, Australia, laurengardner84@gmail.com, David Fajardo

The model presented here seeks to predict the infection pattern which depicts the current state of the network for an ongoing outbreak of a communicable disease. This is accomplished by inferring the most likely path of infection through a contact network under the assumption of partially available infection data. The problem is formulated as a bi-linear integer program, and heuristic solution methods are developed based on iteration of two sub-problems which can be solved much more efficiently.

2 - Developing Non-pharmaceutical Intervention Strategies for Pandemic Influenza Mitigation

Tapas Das, Professor, Department of Industrial and Management Systems Engineering, University of South Florida, Industrial Engineering, Tampa, FL, United States of America, das@usf.edu, Dayna Martinez

In this paper we examine the interactions between the parameters of virus epidemiology, social behavior, and non-pharmaceutical interventions (NPIs). This examination is conducted using an agent-based simulation model and designed statistical experiments. Results are used to design effective NPI strategies for pandemic influenza mitigation. Some numerical results are presented for various virus transmissibility scenarios.

3 - Evaluation of Strategies to Mitigate Contagion Spread using Social Network Characteristics

Mario Ventresca, University of Toronto, 5 King's College Road, Toronto, On, M5S 3G8, Canada, mventresca@gmail.com, Dionne Aleman

We study the effects of graph-based mitigation strategies with respect to their ability to contain disease spread. Evaluation is performed on a social network constructed from census data of the Greater Toronto Area of 5 million individuals. One outcome of the analysis highlights the pitfalls of betweenness and centrality measures for maximum mitigation given an unknown initial spreader. Our analysis focuses on pandemic disease, but the approach is applicable to any network contagion.

4 - Prediction of Demand Surges for Immunization During Influenza Pandemics

Michael Beeler, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, mfbeeler@gmail.com, Michael Carter, Dionne Aleman

A time-series model is constructed to predict surges in turnout at mass immunization clinics during influenza pandemics. Variables include media coverage, weather conditions, day of the week, and estimated weekly infection rate. The model is based on Toronto clinic turnout data during the H1N1 pandemic in 2009.

■ SB25

25- West 213 B- CC

Radiation Therapy Treatment Planning I

Sponsor: Health Applications Society

Sponsored Session

Chair: Edwin Romeijn, Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - A Column-generation-based Technique for Multi-criteria Direct Aperture Optimization

Ehsan Salari, Research Associate, Massachusetts General Hospital and Harvard Medical School, Francis H Burr Proton Therapy, 55 Fruit Street, Boston, MA, 02114, United States of America, salari.ehsan@mgh.harvard.edu, David Craft, Jan Unkelbach

Multi-criteria optimization (MCO) has proved to be a promising approach to radiation therapy treatment planning. MCO is typically employed in the Fluence-map optimization stage to find a Pareto-optimal solution that yields the desired trade-off between treatment evaluation criteria. In this study we investigate the extension of the MCO approach to the direct aperture optimization problem and develop heuristics to obtain a collection of apertures that can approximate the Pareto surface.

2 - Determining Convex Objective Functions and Importance Factors in Multi-criteria IMRT Planning

Taewoo Lee, University of Toronto, 5 King's College Road, Toronto, Canada, taewoo.lee@utoronto.ca, Michael Sharpe, Timothy Chan, Tim Craig

In multi-criteria optimization, objective function parameters are often determined by a trial-and-error process. Multi-criteria IMRT planning typically involves many objective functions, which leads to a large parameter space to search over. We develop an inverse optimization method to determine convex objective functions and parameters that are most critical in treatment planning. Results show the potential to both streamline the planning process and increase the treatment effectiveness.

3 - The Effect of Tumor Repopulation on Fractionation Schedules in Radiation Therapy

Jagdish Ramakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, jagdish@mit.edu, David Craft, Thomas Bortfeld, Jan Unkelbach, John N. Tsitsiklis

We consider optimizing the fractionation schedule and the number of treatment days for radiation therapy. The tumor control probability is maximized subject to a constraint on the normal tissue complication probability. We consider both exponential and gompertzian tumor repopulation between treatment fractions in the linear-quadratic formalism. Such a framework provides insights as to which types of treatment protocols (e.g., hypo-fractionation) are beneficial for various disease sites.

4 - A Method for Improving the Dose Distribution Quality of Multi-criteria Radiation Therapy Plans

Rasmus Bokrantz, KTH Royal Institute of Technology, SE-100 44, Stockholm, Sweden, bokrantz@kth.se

This talk considers an approach to radiation therapy planning where possible treatment options are explored through realtime interpolation over precomputed solutions. A method is presented that improves the quality of interpolated solutions by minimizing a projective distance to the nondominated frontier under constraints on maintained dose distribution quality. Also, minimization of dose changes during conversion into deliverable machine settings are discussed in view of the presented method.

■ SB26

26- North 221 A- CC

Emerging Topics in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Li Chen, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, li.chen@duke.edu

1 - Integrating Inventory Replenishment and Cash Payment Decisions in Supply Chains

Wei Luo, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, wei.luo@duke.edu, Kevin Shang

We provide a modeling framework that integrates financial flows into a two-stage supply chain where each location procures inventory based on cash available. We consider different payment schemes and derive joint optimal and near-optimal inventory and cash policies. Our study demonstrates that an effective cash payment policy can mitigate the supply disruption risk and improve the overall supply chain efficiency.

2 - On the Profitability of an Eco-Friendly Supply Chain

Yang Li, PhD Student, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, yang.li2@duke.edu, Fernando Bernstein, Kevin Shang

We study a two-stage supply chain for eco-friendly problems. The production technology for eco-friendly products is more costly, but these products use components with less fossil-fuel content than regular products. In particular, eco-friendly products are less exposed to the price volatility of petroleum. We examine scenarios in which eco-friendly products are more profitable.

3 - Competitive Quality Choice and Remanufacturing

Adem Orsdemir, Kenan Flagler Business School, University of North Carolina, Chapel Hill, NC, 27599, United States of America, adem_orsdemir@kenan-flagler.unc.edu, Eda Kemahlioglu Ziya, Ali Parlakturk

We consider an Original Equipment Manufacturer who faces competition from an Independent Remanufacturer. We explicitly characterize how OEM competes with IR in equilibrium. IR's entry threat as well as its entry can decrease consumer and social surplus. We show either weak IR or strong IR is desirable for reducing the environmental impact. Comparing our results with benchmarks in which OEM remanufactures suggests that encouraging IRs to remanufacture in lieu of OEMs may not benefit environment.

4 - Fixing Phantom Stockouts: A POS-Based Shelf Inspection Model

Li Chen, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, li.chen@duke.edu

"Phantom stockout" is a retail stockout phenomenon caused by shelf execution failure and/or product shrinkage (e.g., theft and spoilage). In this paper, we propose a simple but effective partially-observable Markov decision process (POMDP) model to tackle this problem. We show that the optimal shelf inspection policy is a threshold policy based on the number of consecutive zero-sales periods. We further extend the analysis to models with time-varying parameters.

■ SB27

27- North 221 B- CC

Supply Chain Models with Multi-sourcing and Information Updates

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Eylem Tekin, Instructional Associate Professor, University of Houston, Department of Industrial Engineering, Houston, United States of America, etekin@central.uh.edu

1 - Inventory Replenishment and Demand Allocation Decisions for Multi-Sourced Items

Abhilasha Katariya Prakash, PhD Student, Texas A&M University, 503 nagle st, apt 102, college station, TX, 77840, United States of America, abhilashapk@neo.tamu.edu, Eylem Tekin, Sila Cetinkaya

We consider a manufacturer using multi-sourced parts from a contractual vendor (CV) and a spot market (SM). The CV holds inventory at a vendor managed hub and charges a fixed unit price under a quantity commitment contract. Inventory procured from the SM with volatile prices is held at an advance purchase hub. The overall problem deals with when and how much to order from each source and how to allocate demand to the alternative hubs.

2 - Dynamic Inventory Replenishment Decisions with Bayesian Learning of Supply Yield Uncertainty

Baykal Hafizoglu, Arizona State University, 699 S Mill Avenue, Tempe, AZ, 85281, United States of America, baykal@asu.edu, Sibel Salman, Esma Gel

We consider a periodic-review inventory replenishment problem with yield uncertainty, where the quantity that the supplier ships in response to an order is random. We assume that the parameters that govern the supplier's yield are not known with certainty in advance. We propose a Bayesian updating scheme that learns supplier's yield parameters over time. We compare performance of Bayesian learning scheme with other strategies such as safety stock policy, and simple heuristics.

3 - Strategic Inventories and Dynamic Coordination with Production Cost Learning

Xiuli He, Assistant Professor, University of North Carolina-Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, xhe8@uncc.edu, Tao Li, Suresh Sethi

We consider a two-period decentralized supply chain in which the manufacturer's production cost declines with cumulative production due to stochastic cost learning. We investigate the impact of learning curve effect on the value of strategic inventory to the channel members. We construct dynamic revenue sharing contracts that coordinate the channel.

4 - Supply-side Rationale for Bundling

Qingning Cao, University of Texas-Dallas, School of Management, 800 West Campbell Road, Dallas, TX, 75080, United States of America, qingning.cao@utdallas.edu, Jun Zhang, Xianjun Geng, Kathryn Stecke

We examine a firm's capacity decisions and restrictions on a popular product when the market is uncertain and the firm has an option to bundle two products. Deriving the firm's optimal bundling strategy, this talk sheds light on the interplay between a firm's capacity (supply-side) and bundling (demand-side) decisions.

■ SB28

28- North 221 C- CC

Customer Behavior and Operations Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Fuqiang Zhang, Olin Business School, Washington University, St. Louis, United States of America, Fzhang22@wustl.edu

1 - Bounded Rationality in Service Systems

Gad Allon, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo

The traditional economics and queueing literature typically assume that customers are fully rational. In contrast, in this paper, we study canonical service models with boundedly rational customers. We capture bounded rationality using a framework in which better decisions are made more often, while the best decision needs not always be made.

2 - Consumer-driven Competition Sets

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Jun Li

We use clickstream data from Expedia to construct and analyze hotel competition sets. We find that these competition sets are drastically different from the traditionally used attribute-based competition sets.

3 - Competing for Socially Conscious Consumers: The Role of Supply Chain Structure

Robert Swinney, Associate Professor, Graduate School of Business, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, swinney@stanford.edu, Ruixue Guo, Hau L. Lee

We analyze a duopoly in which two competing firms choose whether to adopt socially responsible manufacturing practices. Doing so attracts demand from competing firms-those consumers who have a preference for socially responsible production-but also increases costs. We consider the impact of supply chain structure on the firms' decisions, and discuss how the supplier and consumer population characteristics combine to influence the equilibrium degree of social responsibility in the industry.

4 - Responsive Pricing of Fashion Products: The Effects of Demand Learning and Strategic Consumer

Mike Wei, Olin Business School, Washington University, St. Louis, MO, United States of America, weim@wustl.edu, Fuqiang Zhang, Yossi Aviv

We provide a stylized Bayesian demand learning model to investigate the value of responsive pricing under strategic consumer behavior. In particular, we find that increasing market uncertainty affects the value of responsive pricing adversely due to the spread effect and the manipulation effect. Furthermore, it can be shown that the price commitment can boost the seller's revenue substantially, and the information can be much more valuable under strategic consumers than under myopic consumers.

■ SB29

29- North 222 A- CC

Workforce Engineering

Cluster: Workforce Management

Invited Session

Chair: Ruwen Qin, Assistant Professor, Missouri University of Science and Technology, 600 W. 14th St., 218 Engineering Management Building, Rolla, MO, 65409, United States of America, qinr@mst.edu

1 - Cross-training of Team Members to Deal with Demand Mix Variation and Absenteeism

Jordi Olivella, Assistant Professor, Universitat Politècnica de Catalunya, Esteve Terradas, 7, Castelldefels, 08860, Spain, jorge.olivella@upc.edu, David Nembhard

The objectives of this work are: (1) To develop a method to determine the cross-training goals of a work team in order to deal with certain levels of variation in the demand mix and absenteeism; and (2) Evaluating alternative policies of cross-training of team members. The demand mix variation is defined by establishing a maximum time to devote to each product. To solve numerically the mathematical problem generated a selection constraint based procedure is developed.

2 - Strategic Workforce Planning Models for Semiconductor Manufacturing

Shrikant Jarugumilli, Sr. Operations Research Specialist, BNSF Railway, 2400 Western Center Blvd., Ft Worth, TX, 76131, United States of America, Shrikant.Jarugumilli@bnsf.com, Scott Grasman, Naiping Keng

In this work, we propose an integrated framework that links the strategic workforce planning model to the operational workforce allocation models. The strategic workforce planning model enables the planners to make decisions to retain and hire workers, along with the design of worker cross-training programs based on the long-term requirements of the organization.

3 - Development of a Human-based Metric Selection Protocol

Gratchen Macht, Pennsylvania State University, 244 Leonhard Building, University Park, PA, 16802, United States of America, gam201@psu.edu, David A. Nembhard

Relevant solutions to current complex problems require the incorporation of highly functional collaborative skills within a team-like framework. A human-based selection protocol was developed through a mixture of technical skills and psychological profiles to address interdisciplinary teams. The results impact team formulation to improve the overall team performance.

4 - Optimal Flow-line Conditions with Worker Variability

Frank Bentefouet, Research Assistant, Pennsylvania State University, 1231 South Allen Street, State College, PA, 16801, United States of America, fub3@psu.edu, David Nembhard

In this paper, we propose a framework to study the workforce scheduling problem in an assembly line also called flow line. We investigate the impact of within-worker and between workers variability and discuss the selection of a scheduling policy between fixed and work sharing system. We characterize the optimal switching time between workers in a system with two tasks and establish the maximum number of changes between assignments when considering a general floor shop.

■ SB30

30- North 222 B- CC

Supply Chain Risk Management

Sponsor: Manufacturing & Service Oper Mgmt/IFORM

Sponsored Session

Chair: Zhibin (Ben) Yang, Assistant Professor, University of Oregon, 1208 University of Oregon, Eugene, 97403, United States of America, zyang@uoregon.edu

Co-Chair: Volodymyr Babich, Assistant Professor, McDonough School of Business, Georgetown University,37th and O Streets, NW, 546 Rafik B. Hariri Building, Washington, DC, 20057, United States of America, vob2@georgetown.edu

1 - Sourcing Strategies under Supply Yield Uncertainty

Guang Xiao, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, xiaoguang@wustl.edu, Lingxiu Dong, Nan Yang

We consider a one-buyer-multi-supplier system in the presence of supply yield uncertainty. We explore the impact of various supply contractual arrangements and different yield uncertainty profiles on the equilibrium supply chain performance.

2 - The Impact of Cost and Quality on Illegal Goods in the Supply Chain

Maqbool Dada, Professor, Johns Hopkins Carey Business School, 100 International Drive, Baltimore, MD, 21202, United States of America, dada@jhu.edu, Arkadi Seidscher, Stefan Minner

A manufacturer of a branded product may deter competition from parallel imports, smuggled goods or counterfeits by investing in higher quality and lowering price. A four stage model of competition is developed to examine the impact of such competition. The analysis also has implications for legal means of competition; for example, from store brands in supermarkets or generic drugs in pharmacies.

3 - How To (and How Not To) Manage Supplier's Process Improvement: Delegation, Incentives, or Audit

Mehmet Gumus, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, mehmet.gumus@mcgill.ca, Mohammad Nikoofal

In this paper, we explore the effectiveness of process improvement as a supply disruption mitigation strategy in the presence of moral hazard and adverse selection. In order to address these issues, we develop a dyadic supply chain model where both the degree of supply disruption risk and supplier's mitigation effort are unobservable from retailer. Our analysis shows that eliminating moral hazard via monitoring has a non-monotonic effect on the screening cost.

4 - Intermediated Sourcing under Supply Disruption Risk

Zhibin (Ben) Yang, Assistant Professor, University of Oregon, 1208 University of Oregon, Eugene, 97403, United States of America, zyang@uoregon.edu, Volodymyr Babich

We analyze a model where multiple buyers decide whether to procure goods from unreliable suppliers directly or using an intermediary firm. We show that low-revenue buyers may enjoy spill-over benefits of procurement cost reduction when high-revenue buyers choose to use the intermediary. Intermediation may also reduce system-wide product waste, by coordinating diversification efforts across buyers. These benefits have to be weighed against intermediation costs, such as double-marginalization.

■ SB31

31- North 222 C- CC

Supply Chain Risk and Resilience

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Kash Barker, Assistant Professor, School of Industrial and Systems Engineering, University of Oklahoma, 202 W. Boyd St., Rm 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Disruption Management during Supply Chain Disruptions

Cameron MacKenzie, University of Oklahoma, 202 W. Boyd St., Norman, OK, United States of America, cmackenzie@ou.edu, Kash Barker

Many firms suffered from supply disruptions due to the recent Japanese earthquake and tsunami. We analyze these disruptions by developing a model in which several suppliers' production facilities are rendered inoperable. Each supplier must decide whether to move production to an alternate facility or wait for its facility to reopen. If suppliers do not produce at alternate facilities, firms will need to decide how to mitigate the impacts of a supply shortage.

2 - Resilient Supply-chain Network Design with Multi-sourcing

Haifei Yu, PhD, Northeastern University, No.11, Lane 3, WenHua Road, Heping District,Liaoning, Shenyang, 110004, China, hfyu@mail.neu.edu.cn, Shoufeng Ji

With the uncertainty risk of supply disruptions, it is critical for the supply-chain system to be resilient. We study the problem of designing a resilient supply chain network with multi-sourcing, and propose a chance-constrained programming model, and use a mixed integer linear programming to solve it. We evaluate the benefit of multi-sourcing, balance operation costs, resilience, and disruption risk by the computational experiments.

3 - Prediction and Prevention of Disruptions in Supply Chain Networks

Xin Chen, Assistant Professor, Southern Illinois University Edwardsville, 3079 Engineering Building, Edwardsville, IL, 62026-1805, United States of America, xchen@siue.edu

The objective of this research is to apply the failure mode, effects, and criticality analysis (FMECA) and graph theory to predict and prevent disruptions in supply chain networks. A network may be disrupted due to node failures. A node represents a supplier, customer, or transportation route. This research applies graph theory to model supply chain networks and uses the FMECA to identify critical nodes. A case study of a construction supply chain is analyzed to validate the methodology.

4 - Supply Chain Resilience

Ivan Hernandez, Stevens Institute of Technology, 167 8th Street, Apt 4, Hoboken, NJ, 07030, United States of America, ihernand@stevens.edu, Jose Ramirez-Marquez, David Nowicki

We present a method that allows decision makers to ensure a Supply Chain (SC) returns to a high level of performance following a contingency. We introduce the concept of SC resilience as a function of the post-event investment resources needed for the SC to "bounce back". The concepts can be used as a guide for companies to use their long-term SC plan as a starting point, then begin to ask themselves what they would do if various contingencies occur.

■ SB32

32- North 223- CC

Assembly Line Design and Balancing I

Contributed Session

Chair: Slim Daoud, Université de Technologie de Troyes, 32 Rue du Palais de Justice, Troyes, 10000, France, slim.daoud@utt.fr

1 - Spreadsheet Based Optimization for Cell Formation Problem

Gurkan Ozturk, Assistant Professor, Anadolu University, Faculty of Engineering, Department of Industrial Eng., Eskisehir, 26555, Turkey, gurkan.o@anadolu.edu.tr, Mumin Sonmez

In this study, a new hybrid algorithm based on competitive neural network and particle swarm optimization approaches is proposed to solve cell formation problem with alternative part routings. This algorithm is implemented in two spreadsheet platform: MS Excel and Google Spreadsheet. Although MS Excel faster than the Google Spreadsheet, the property of internet access of google spreadsheet presents different advantages.

2 - Neuro-fuzzy-genetic Algorithm for the Robotic Assembly Lines Balancing

Slim Daoud, Université de Technologie de Troyes, 32 Rue du Palais de Justice, Troyes, 10000, France, slim.daoud@utt.fr, Yalaoui Farouk, Amodeo Lionel, Chehade Hicham, Duperray Philippe

We are interested in an industrial application of a robotic assembly line problem. It consists of seizing the products on a moving conveyor and placing them on different deposit points. The goal is to optimize the efficiency of the line. As in our industrial application we are bounded by the execution time, we suggest a genetic algorithm combined with a neuro-fuzzy network to solve our problem. The experimental results show the advantages and the efficiency of the developed method.

3 - Balancing Mixed Model Assembly Line with Capacity Buffer

Jinlin Li, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, China, ljl1019@163.com, Jie Gao, Linyan Sun

This paper investigate the design of a mixed model assembly line with capacity buffer to satisfy unstable demands. The objective is to minimize the expected labor cost, including cost for normal operation and overtime work. A mathematic model is built and a method is proposed to estimate the cost lower bound. A branch, bound and remember algorithm is developed and the numerical experiment shows that the algorithm is effective and efficient.

4 - Recognition of Freeform Surface Sheet Metal Features

Saied Darwish, Professor, King Saud University, Riyadah, 800/11421, Saudi Arabia, darwish@ksu.edu.sa, Hammouda Mousal

This paper describes the design and implementation of a system for automated feature recognition of freeform surface CAD models of stamped and notched sheet metal parts, represented in STEP AP203 format through CATIA V5.

■ SB33

33- North 224 A- CC

Modeling Sustainability in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Krishnan Anand, Associate Professor, University of Utah, David Eccles School of Business, Salt Lake City, UT, 84108, United States of America, k.anand@utah.edu

1 - Finding and Implementing Energy Efficiency Projects in Industrial Facilities

Sam Aflaki, HEC, France, aflaki@hec.fr, Paul R. Kleindorfer

There are many profitable Energy Efficiency projects in many industrial enterprises that are not implemented. One of the main barriers often cited as the main culprit is lack of an internal management framework to find, value and execute these projects. Using a conceptual approach, we rely on the existing sustainable operations tools to provide such a framework. A case example of a large manufacturing site illustrates the details of this framework.

2 - Closed-loop Supply Chain Design under Uncertainty

Vedat Verter, Professor, McGill University, 1001 Sherbrooke St. W., Montreal, QC, H3A 1G5, Canada, vedat.verter@mcgill.ca, Wenyi Chen, Beste Kucukyazici

We present a mathematical formulation for designing a closed-loop supply chain under uncertainties with regards to demand, return rate and recovery rate. The model is applied in studying a realistic problem instance that involve the production and recycling of washers and tumble dryers in Germany. We will presents the managerial insights derived from a large set of computational experiments.

3 - Consumer Markets for Remanufactured Products: Empirical Evidence and Economic Models

James Abbey, Pennsylvania State University, 463A Business Building, University Park, PA, 16802, United States of America, jda188@psu.edu, Dan Guide, Joseph Blackburn

When considering remanufactured products, do consumers follow the typical principle of 'cheaper is better' or do other rules apply? Additionally, do consumer markets for remanufactured products demonstrate homogeneous price-taking behavior? This research addresses these and other questions in relation to consumer markets for remanufactured products. Insights derive from triangulation of empirical investigations and tightly coupled economic modeling.

4 - Investing in Pollution Abatement Innovations under Emission Taxes and Cap-and-trade

Francois Giraud-Carrier, University of Utah, David Eccles School of Business, 1645 E Campus Center Dr, Salt Lake City, UT, 84112, United States of America, f.giraud-carrier@business.utah.edu, Krishnan Anand

We compare the incentives of polluting firms to invest in an innovative pollution abatement technology under two popular pollution governance structures—emission taxes and cap-and-trade. In our model, firms first decide whether to adopt the (costly) innovative technology, and then make production and abatement decisions. We compare the impact of each governance structure on firms' pollution abatement strategies, output and profits, consumer surplus and welfare.

■ SB34

34- North 224 B - CC

Product Achitecture and Design

Contributed Session

Chair: John Jung-Woon Yoo, Assistant Professor, Bradley University, 1501 W. Bradley Ave., Peoria, IL, 61625, United States of America, jyoo@bradley.edu

1 - Small Modular Infrastructure

Caner Gocmen, Columbia Business School, 3022 Broadway, Uris Hall, 4V, New York, NY, 10027, United States of America, fgocmen13@gsb.columbia.edu, Garrett Van Ryzin, Eric Dahlgren, Klaus Lackner

In many basic infrastructure industries, such as electric power generation, we have witnessed a trend of ever increasing unit size. We argue for a reversal of this trend - a radical shift to a world in which custom built technology of massive unit scale is replaced by small, modular and mass-produced units. To make this case, we develop a framework to evaluate the economics of unit scale and argue that many industries are already at a tipping point toward radically smaller unit scale.

2 - Strategic Linkages of Product Architecture Decisions: Organizational and Performance Implications

Ujjal Mukherjee, Research Assistant, University of Minnesota, 1261 Gibbs Ave., Apt G, Saint Paul, MN, 55108-1159, United States of America, mukh0067@umn.edu

What are the strategic linkages to product architecture decisions and what are the organizational and performance implications of such linkages? We adopt an 'alignment' perspective for the strategic positions, and the product architecture decisions. This frame-work is used as a basis to develop a proposed product architecture categorization and organizational architecture linkages. The framework includes the linkages 'strategic positioning – product architecture-organization-performance'.

3 - Social Network Effects on Product Line Design

Dilek Gunnec, University of Maryland, 3330 Van Munching Hall, College Park, MD, 20742, United States of America, dgunnec@rhsmith.umd.edu, Subramanian Raghavan

We model peer influence effects among the social network of users of products from the same product line. Influence among customers alters their utilities from the products, and therefore do not allow for an a priori preference ordering for an individual among different product profiles at the outset. We analyze product diffusion processes over the network and identify the set of products to maximize the total market share when each customer selects the product with the highest utility.

4 - Performance Evaluation of Interface-based Solution Procedures for Modular Product Design

John Jung-Woon Yoo, Assistant Professor, Bradley University, 1501 W. Bradley Ave., Peoria, IL, 61625, United States of America, jyoo@bradley.edu

In our earlier work we have proposed a collaboration system for modular product design and proposed three interface-based solution approaches, a mathematical approach based on Integer Programming, an algorithmic approach based on branch-and-bound method and, finally, a heuristic method. The first two approaches are for the optimal solution, while the last one is for a heuristic solution. In this talk, the experimental results are discussed and the performance of the three approaches is compared.

■ SB35

35- North 225 A- CC

Dynamic Pricing

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Ming Chen, Assistant Professor, California State University, School of Business Administration, Long Beach, CA, 90840, United States of America, Ming.Chen@csulb.edu

1 - Robust Customized Pricing

Elcin Cetinkaya, Doctoral Student, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, 18015, United States of America, elcin.cetinkaya@lehigh.edu, Aurelie Thiele

We study robust revenue management problems when companies request bids for services but their price-response function is not known precisely. The company bidding for these contracts only knows the previous bids it submitted to those businesses and whether they were accepted or not. We show how to derive tractable mathematical models for this problem and provide insights into the optimal solution. We also document the performance of the approach in numerical experiments.

2 - Joint Pricing and Inventory Decisions under Poisson Decomposition with Insights on Optimal Assortment

Bacel Maddah, Associate Professor, American University of Beirut, Bliss Street, Beirut, Lebanon, bm05@aub.edu.lb, Ebru Bish, Hussein Tarhini

We consider substitutable retail products in a market with logit choice, demand generated by Poisson decomposition, and a newsvendor-type supply setting. We focus on the joint pricing and inventory problem for a given assortment, under a highly accurate Taylor-like approximation. We show that the expected profit is unimodal in the price and analyze the effect of inventory on pricing. Then, with no approximation, we analyze the joint assortment and inventory problem, and derive novel insights.

3 - Survey of Dynamic Pricing Research on Selling a Given Inventory over a Finite Horizon

Ming Chen, Assistant Professor, California State University, School of Business Administration, Long Beach, CA, 90840, United States of America, Ming.Chen@csulb.edu

We present a review of existing research on dynamic pricing problems involve selling a given amount of inventory over a finite time horizon without inventory replenishment. We classify these problems into several classes based on a number of problem attributes and summarize main findings and managerial insights.

■ SB36

36- North 225 B- CC

New Directions in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Omar Besbes, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu

Co-Chair: Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu

1 - Intertemporal Price Discrimination: Structure and Computation of Optimal Policies

Ilan Lobel, New York University, Stern Business, 44 W 4th St., New York, NY, United States of America, ilobel@stern.nyu.edu, Omar Besbes

We consider the problem of a firm selling goods over time to customers with heterogeneous patience levels. We let customer valuations be correlated with their willingness-to-wait and look for a dynamic pricing policy that maximizes the long-term revenue of the firm. We prove several structural properties of the optimal pricing policy and develop a dynamic programming algorithm that computes the optimal policy in polynomial time.

2 - ADP For (Very) High Dimensional Resource Allocation

Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vivekf@mit.edu, Dragos Florin Ciocan

Due to the heterogeneous nature of the resource being allocated (impressions), online Ad Display allocation presents a challenge to traditional revenue management approaches. We present a novel ADP inspired clustering technique that allows for real time resource allocation in such problems. Since this scheme is calibrated through solving a natural, but massive linear program, we also deploy a scheme that can solve effectively arbitrarily large LPs in a decentralized manner.

3 - Optimal Timing of New Product Introduction using Preliminary Market Testing

Rene Caldentey, New York University, 44 West Fourth Street, New York, NY, United States of America, rcaldent@stern.nyu.edu, Victor Araman

Introducing new products into the marketplace is a risky bet that manufacturers must continuously take. As a result, it is not uncommon to witness major manufacturers discontinuing a product shortly after its introduction. In this talk, we consider a seller who first tests the market and learns more about the demand before deciding whether or not to launch a product (or set of products). We also discuss current e-commerce practices that have increase companies' ability to do such market testing.

4 - Auctions Design for Online Display Advertising Exchanges

Santiago Balseiro, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, srb2155@columbia.edu, Omar Besbes, Gabriel Weintraub

Ad Exchanges are emerging markets where advertisers may purchase display ad placements directly from publishers via a simple auction mechanism. Using the novel notion of a Fluid Mean Field Equilibrium we study key auction design decisions that publishers face in these markets. In particular, we provide sharp prescriptions regarding the reserve price, the allocation of impressions to the exchange versus an alternative channel, and the disclosure of viewers' information.

■ SB37

37- North 226 A- CC

Dynamic Pricing in Supply Chains

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Jian Li, Assistant Professor, Northeastern Illinois University, 5500 N. St. Louis Ave, Chicago, IL, 60625, United States of America, j-li3@neiu.edu

1 - The Inventory Billboard Effect on Information Sharing in Competing Supply Chains

Zhengping Wu, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, Singapore, zpwu@smu.edu.sg, Rong Li, Xin Wei

The inventory billboard effect in operations management indicates that the increasing shelf-space allocated to a product has a positive effect on the product demand. This paper studies the billboard effect on the vertical information sharing strategy of competing supply chains in an environment with production diseconomies. We analyze how equilibrium information sharing strategy, wholesale price and retail quantity are affected by the billboard effect coefficient.

2 - Price Trends in Dynamic Pricing Models

Xiaowei Xu, Associate Professor, Rutgers Business School, 1 Washington Park, Room 958, Newark, NJ, 07102-3122, United States of America, xiaoweix@business.rutgers.edu

We consider a seller that has a limited amount of asset to liquidate in a finite time horizon. Demand signals are updated at preset time spots and the seller can adjust the product price accordingly. We offer the managerial insights of how probabilistic price trends are affected by time-varying and price-sensitive demand forms via exploring the recursive structure of the optimal pricing policy and the implied martingale decomposition.

3 - Dynamic Pricing with Random Replenishment Capacity

Jian Li, Assistant Professor, Northeastern Illinois University, 5500 N. St. Louis Ave., Chicago, IL, 60625, United States of America, j-li3@neiu.edu, Xiaowei Xu

In this research, we study the decision problem facing a retailer who sells a short seasonal product inventory in a stylized model. The retailer has an uncertain second chance to refill its inventory. We analytically derive the structure of the optimal dynamic pricing policy and procurement decisions. We also explore the properties of the optimal dynamic pricing and the expected profit function.

■ SB38

38- North 226 B- CC

Service Innovations in the Global Marketplace

Sponsor: Service Science

Sponsored Session

Chair: Christian Wernz, Assistant Professor, Virginia Tech, 205 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, cwernz@vt.edu

1 - Service Engineering – Trends, Perspectives and the Contribution to Service Science

Walter Ganz, Director, Fraunhofer IAO, Nobelstr. 12, Stuttgart, 70569, Germany, Walter.Ganz@iao.fraunhofer.de, Thomas Meiren

A large amount of work has been done in relation to the definitions, typologies of services. It is noticeable that the development of fundamental models for services has tended to be neglected. Discussing the options of model creation as well as the simulation of services was a central topic of our expert study "MARS". It becomes obvious that the creation of models as well as simulation has gained an importance within the last years and it could make a relevant contribution for Service Science

2 - Firm Value of Product Innovation in Service Ecosystems: A Study of Smartphones

Rahul Basole, Associate Director and Senior Research Scientist, Tennenbaum Institute, Georgia Institute of Technology, 75 Fifth Street NW, Suite 600, Atlanta, GA, 30308, United States of America, rahul.basole@ti.gatech.edu, Hyunwoo Park

We examine the asymmetric impact of product innovation on the market value of manufacturers (e.g. device manufacturers) and service providers (e.g. mobile network operators) in the mobile service ecosystem. Our analysis is based on a comprehensive dataset comprising over 1,500 smartphones and considers the influence of product characteristics, the frequency and timing of product innovation, and the network structure of the service ecosystem. Theoretical and managerial implications are discussed.

3 - The Design of Experiential Services
Uday Karmarkar, Professor, UCLA, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, uday.karmarkar@anderson.ucla.edu, Aparupa Das Gupta, Guillaume Roels

We address sequencing and resource allocation of stages in a multi-stage service encounter where customer perceptions of experience are important, as in the hospitality industry. We employ evidence from behavioral studies about how people evaluate and retain memories of experiences. We model these phenomena parsimoniously, and use the models to design service processes so as to maximize ex-post customer satisfaction.

4 - Service Convergence: A New Phenomenon?
Christian Wernz, Assistant Professor, Virginia Tech, 205 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, cwernz@vt.edu, Pooja Thakur, Kongkiti Phusavat

We investigate the phenomenon of service convergence. Service convergence is defined as the tendency of previously separate service offerings to evolve towards an integrated product. We analyzed the business strategy of a Thai hospital and identified service convergence as a result of the firm's quality improvement and innovation initiative. We discuss how the integration of medical services with hospitality services contributed to the hospital's success in the medical tourism industry.

■ SB39

39- North 226 C- CC

Service Quality Evaluation and Customer Retention

Sponsor: Service Science

Sponsored Session

Chair: Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu

1 - Development of a Service Quality Evaluation Scheme in a Service Laboratory Environment
Ryeok-Hwan Kwon, Pohang University of Science and Technology, Engineering Buliding #4-316, Hyoja-Dong, Nam-Gu, Pohang, Kyungbuk, Pohang, Korea, Republic of, rh_kwon@postech.ac.kr, Hyun-Jin Kim, Kwang-Jae Kim

A virtual reality (VR) laboratory for service testing has been constructed in Korea. One issue associated with its operation is how to evaluate the quality of a service tested in a laboratory environment. We present a service quality evaluation scheme for a service laboratory environment, consisting of two parts: a repository of service evaluation criteria and a guideline to select pertinent criteria for a particular case study. The result of a case study will also be presented.

2 - Factors Affecting Students' Perceptions of Quality in Higher Education
Martha Ramírez-Valdivia, Assistant Professor, Universidad de La Frontera, Avenida Francisco Salazar 01145, Temuco 4780000, Chile, marthar@ufro.cl, Favia Catrileo, Horacio Miranda

This study identified which background dimensions influences student perceptions of quality in higher education. A questionnaire was applied to 27,182 chilean university students; 687 responses were received, 223 valid ones. A factorial analysis verified accuracy and validity. The main findings indicate that the lecturer¥s competencies and the lecturer¥s attitude and behavior are the main determinants in the provision of quality education. The perception of the quality service is medium to low.

3 - Dynamic Customer Acquisition and Retention Management
Greg King, PhD Candidate, University of Michigan, Department of Industrial and Operations, Ann Arbor, MI, United States of America, gjking@umich.edu, Xiuli Chao, Izak Duenyas

In consulting, finance, and other service industries, customers represent a revenue stream, and must be acquired and retained over time. In this paper, we study the resource allocation problem of a profit maximizing service firm that dynamically allocates its resources towards acquiring new clients and retaining unsatisfied existing ones. We formulate the problem as a dynamic program and characterize the structure of the optimal acquisition and retention strategy.

■ SB40

40- North 227 A- CC

Stochastic Hydro-Thermal Scheduling I

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Steffen Rebennack, Assistant Professor of Operations Research, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, srebenna@mines.edu

Co-Chair: Timo Lohmann, PhD Student, Colorado School of Mines, 816 15th Street, Golden, CO, 80401, United States of America, tlohmann@mines.edu

1 - A Dynamic Piecewise Linear SDDP Algorithm Applied to Stochastic Nonlinear Hydrothermal Scheduling
Andre Luiz Diniz, Researcher, CEPEL-Brazilian Electric Energy Research Center, Av. Horacio Macedo 354, Cidade Universitária, Ilha do Fundão, Rio de Janeiro, RJ, 22220040, Brazil, diniz@cepel.br, Michel Ennes, Renato Cabral

We propose dynamic piecewise linear models to represent nonlinear constraints and objective function in stochastic multi-stage convex optimization problems solved by stochastic dual dynamic programming (SDDP). The proposed approach provides valid cuts and convergence bounds and yields more accurate results as compared to standard piecewise linear models, in lower CPU times. We present results of its application for the generation planning of the real large-scale Brazilian hydrothermal system.

2 - Representation of Nonconvexities in Stochastic Dual Dynamic Programming (SDDP)
Fernanda Thomé, Research Engineer, PSR, Praia de Botafogo 228/1701-A, Rio de Janeiro, RJ, 22250145, Brazil, fernanda@psr-inc.com, Mario Veiga Pereira, Sérgio Granville, Marcia Fampa

This work describes an extension of the SDDP algorithm to represent nonconvexities such as variation of hydro production coefficient with storage and thermal unit commitment. The proposed methodology uses a Lagrangean relaxation on the water balance equation to generate convex Benders cuts during the backward recursion phase, with a special procedure to find the optimal multiplier. The approach will be illustrated with a realistic hydrothermal scheduling problem.

3 - Optimizing Trading Decisions for Hydro Storage Systems using Approximate Dual Dynamic Programming
Nils Löhndorf, Vienna University of Economics and Business, Nordbergstr 15/3/A, Vienna, 1090, Austria, nils.loehndorf@wu.ac.at, David Wozabal, Stefan Minner

Optimal operation of hydro storage systems in electricity markets is a complex stochastic optimization problem. We formulate this problem as a Markov decision process where a stochastic mixed-integer program is solved in each time period. To find a near-optimal policy, we propose a solution approach that computes a polyhedral approximation of the value function. We describe how we applied the approach to optimize the operation of a real-world hydro storage system in the Austrian Alps.

■ SB41

41- North 227 B- CC

Regulation in Energy

Contributed Session

Chair: Eric O'Rear, Graduate Student, Purdue University, 403 W. State Steet, West Lafayette, IN, 47907, United States of America, eorear@purdue.edu

1 - A Decision Support Tool for Evaluating Regional Greenhouse Gas Emission Reduction Strategies
Rick Olson, University of San Diego, 5998 Alcala Park, San Diego, CA, 92110, United States of America, r_olson@sandiego.edu, Scott Anders, Andrew Narwold, Nilmini Silva-Send

Cities and counties planning policies to meet GHG reduction goals often focus on the direct impact of specific policy changes, e.g. increasing the use of mass transit. The interactions between factors, such as mass transit and telecommuting, are more difficult to understand. The paper presents a DSS that can be used by regional planners to develop strategies for meeting GHG reduction targets while considering the relationships between factors and the costs of the policies.

2 - Regulated Design & Pricing in the New Vehicle Market
William Morrow, Assistant Professor, Iowa State University, 2104 Black Engineering Building, Ames, IA, 50011-2161, United States of America, wrmorrow@iastate.edu, Josh Mineroff, Kate S. Whitefoot

Regulations influence vehicle design and pricing. However, few models of policy impacts include strategic design decisions in response to regulation. This talk describes simulation of equilibrium design and pricing decisions under regulation. Examples are given for the new vehicle market and associated fuel economy standards. Our results demonstrate that simulations that neglect strategic behavior may overestimate the effectiveness of current policy approaches.

3 - The Rebound Effect and its Implications on Obama's Plan for a Clean Energy Future
Eric O'Rear, Graduate Student, Purdue University, 403 W. State Steet, West Lafayette, IN, 47907, United States of America, eorear@purdue.edu, Wallace Tyner, Kemal Sarica

Our paper will compare the impacts of Obama's modifications to CAF... standards, with a more efficient carbon tax generating a similar level of CO2 reductions. Further, we intend to capture the impacts of the "rebound effect" phenomenon associated with a mandate for a higher fuel economy on the U.S. energy system. We utilize the U.S. EPA MARKAL model - a bottom-up, linear programming (LP), partial equilibrium model – to replicate and compare the policies aligned with our interests.

4 - Optimal Number of Certificates to be Issued in Emission Markets
Cristian Pelizzari, University of Brescia, Contrada Santa Chiara, 50, Brescia, 25122, Italy, pelizcri@eco.unibs.it, Falbo Paolo

The price of allowances in the EU ETS is linked to the value of the expected penalty for the CO2 produced in excess by diverse economic players. Too severe environmental policies cause a rise in the price of allowances. The compliance of such objectives can increase production costs causing inflation and loss of competitiveness. A stochastic programming model is advanced where the regulatory authority trades-off economic growth with environmental targets, influencing the choices of the players by means of the number of allowances to be issued.

■ SB42

42- North 227 C- CC

Tactical Issues in Freight Transportation

Contributed Session

Chair: Mihalis Golias, University of Memphis, 104 Engineering Science Bldg, 3815 Centr, Memphis, 38152, United States of America, mgkolias@memphis.edu

1 - Model Slection for Shipper's Mode Coice
Subhro Mitra, Assistant Professor, University of North Texas, University Hills Blvd., Dallas, TX, 75241, United States of America, subhro.mitra@unt.edu, Ali S. Shaqlaih

This paper presents discrete choice models developed to determine the probability of mode choice between railroad and truck, based on revealed preference data. Utility functions are formulated using the attributes of the modes, shippers and interaction between the two. The choice probability is initially estimated assuming the random component to have a logit distribution. The model is further developed assuming the stochastic component to have heteroscedastic and probit distribution.

2 - Efficient Heuristic for Auto-carrier Loading Problem
Saravanan Venkatachalam, Research Associate, Texas A&M University, 304A Fermier Hall, 3367 TAMU, College Station, TX, 77843, United States of America, saravanan@entc.tamu.edu, Arunchalam Narayanan, Bimal Nepal

This belongs to a special group of logistics problem, as it needs solution for two NP-hard subproblems, namely routing and loading. There are several efficient methods for the routing part, but very few for the loading aspect. Existing methods in literature concentrate on the cost of loading and reloading and approximate the geometric, weight, and mechanical constraints of the vehicles. We demonstrate the application of a new heuristic which incorporates all these loading constraints.

3 - Load Mixing with Freight Due Dates
Sarah Root, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, seroot@uark.edu, Crystal Wilson

The underutilization in trucking leads to nearly 5 billion gallons of wasted fuel annually. One way to recapture part of this waste is to use collaborative logistics. This research focuses on one specific aspect of collaborative logistics: load mixing. Load mixing is the idea of mixing two or more items of different weights in the same container to reduce the number of trucks needed. In this research we explore the impact of product due dates on the mixing of commodities to more utilize trucks. We propose heuristics to solve this problem, and present computational results from this work.

4 - Cost-stable Truck Scheduling at a Cross-dock Facility with Unknown Truck Arrivals
Mihalis Golias, University of Memphis, 104 Engineering Science Bldg, 3815 Centr, Memphis, 38152, United States of America, mgkolias@memphis.edu, Dincer Konur

We study a cross-dock operator's truck scheduling problem at inbound doors in case of unknown truck arrival times. Due to uncertainty of truck arrivals, a scheduling strategy is defined as a schedule with low variation levels. A bi-objective optimization problem is formulated and we discuss a genetic algorithm based heuristic to find Pareto efficient schedules. The proposed approach is compared to first-come-first-served policies.

■ SB43

43- North 228 A- CC

RAS Problem Solving Competition

Sponsor: Railway Applications

Sponsored Session

Chair: Kamalesh Somani, Manager Operations Research, CSX Transportation, 500 Water St, Jacksonville, FL, 32202, Kamalesh_Somani@csx.com

1 - Movement Planner Algorithm Design for Dispatching on Multi-Track Territories
Kamalesh Somani, Manager Operations Research, CSX Transportation, 500 Water St., Jacksonville, FL, 32202, Kamalesh_Somani@csx.com

A dispatcher's task is to give track authorities to trains to maximize overall system efficiency while abiding by a number of business rules. This is done by deciding which train takes the siding when two trains traveling in opposite directions meet each other, or when a faster train is to overtake the leading slower train. They must also decide on the departure and hold times at the yard where train originate terminate or stop for work events. The three finalists will compete at this session.

■ SB44

44- North 228 B- CC

Topics in Supply Chain Management

Contributed Session

Chair: Tracy Johnson-Hall, Assistant Professor, Mason School of Business, College of William & Mary, P.O. Box 8795, Williamsburg, VA, 23187-8795, United States of America, tdjohns@clemson.edu

1 - Isomorphism Pressures and Management Support: An Empirical Investigation in Supply Chain Security
Guanyi Lu, PhD Candidate, Mays Business School at Texas A&M University, 320N, 4217 TAMU, College Station, TX, 77843-4217, United States of America, glu@mays.tamu.edu, Xenophon Koufteros

This study examines the antecedents and consequences of supply chain security practices. Data analyses based on 193 U.S. firms suggest that only normative and performance pressures have a sizable effect on top management support toward security (TMS). The results also show that TMS affects proactive and contingency planning which have strong positive effects on security performance.

2 - Motivation of Time Compression Diseconomies on Transitory Network Collaborations
Adrian Tan, PhD Candidate, Wilfrid Laurier University, 75 University Avenue West, Waterloo, ON, N2L 3C5, Canada, tanx1410@mylaurier.ca, Hamid Noori

Time-based competition is increasingly used across multiple industries as a basis for strategic advantage. However, the challenge of time compression diseconomies constraint companies from building internal resources for competitive purposes as rapidly as might be desirable. An empirical study to assess if companies can meet the challenge by engaging in transitory network collaborations is presented.

3 - Time to Recall: A Duration Analysis Model of Recall Strategies and Effectiveness

Tracy Johnson-Hall, Assistant Professor, Mason School of Business, College of William & Mary, P.O. Box 8795, Williamsburg, VA, 23187-8795, United States of America, tdjohns@clemson.edu, Manpreet Hora, Aleda Roth

We study the role of supply chain characteristics and strategies adopted by firms during product recalls and their association with time to recall for perishable goods, specifically food products. We employ a duration analysis to examine this association. We discuss our results and their implications for firms, consumers and policy-makers.

4 - Order Quantity Variability in Perishable Product Supply Chains

Stefan Minner, Professor, Technische Universitat München, TUM School of Management, Arcisstr 21, Munich, 80333, Germany, stefan.minner@tum.de, Sandra Transchel

We analyze orders for perishable products under customer reactions to stockouts and inventory issuing policies. Variability of order quantities is lower than demand variability and implies a reduced bullwhip effect. We show that different combinations of stockout and issuing policies exhibit different order quantity variability with increasing service level and discuss a choice game where supplier and retailer can choose between the available options of stockout and depletion policy.

■ SB45

45- North 229 A- CC

JFIG Paper Competition II

Sponsor: Junior Faculty Interest Group

Sponsored Session

Chair: Esra Buyuktahtakin, Assistant Professor, Wichita State University, IME Department, Wichita, KS, United States of America, esra.b@wichita.edu

1 - JFIG Paper Competition

Esra Buyuktahtakin, Assistant Professor, Wichita State University, IME Department, Wichita, KS, United States of America, esra.b@wichita.edu

Papers are submitted for this year's JFIG paper competition, and each one is evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. In this session, finalists-selected in two rounds of review, will present their papers. For the selected finalists and the abstracts of the selected papers, please refer to the online program.

■ SB46

46- North 229 B- CC

Organizational and Industry Renewal (II): Legitimacy, Social Norms, and Environmental Dynamics

Sponsor: Organization Science

Sponsored Session

Chair: Andreas Schwab, Associate Professor, Iowa State University, 3315 Gerdin, Ames, IA, 50011, United States of America, aschwab@iastate.edu

1 - The Entrepreneur as David on Horseback

Joseph Broschak, Associate Professor, University of Arizona, Eller College of Management, Department of Management & Organizations, Tucson, AZ, 85721, United States of America, broschak@email.arizona.edu, Kenneth Koput

We investigate the role of social identity, information sources, and networks on new technology adoption. In the horse industry, the horseshoe is a path-dependent technology. Most horses are shod with the steel keg shoe that has been the dominant design since the 1800s, despite widespread changes in how horses are owned, kept, and used, and alternative shoe designs. Using survey data of horse owners, we explore how different social influence variables affected technology adoption decisions.

2 - When Practices Diffuse in a Bubble: Reverse Mergers and the Internet Wave

Peggy Lee, WP Carey-ASU, 300 E. Lemon St., Tempe, 85287, United States of America, Peggy.Lee@asu.edu, Ivana Naumovska, Edward Zajac

We theoretically and empirically examine the diffusion process in a bubble context. In doing so, we synthesize information-based theories of imitation with institutional theory to explain the growth and decline of reverse mergers (RM) of internet firms during the time of the internet wave (1998-2000). Our results show a clear two-stage pattern, with early RMs done by established firms, and late RMs done by fledgling firms. We also find evidence of an early mover advantage.

3 - The Dynamic Mdel of Onership Hterogeneity and Corporate Social Responsibility

Nai Hua Wu, Texas A&M University, 4221 TAMU, College Station, TX, 77843, United States of America, nwu@mays.tamu.edu, David Sirmon

Research in corporate social responsibility (CSR) has focused mainly on managerial discretion or stakeholders. We intend to fill the gap by addressing CSR from the corporate governance perspective, specifically, the effect of ownership heterogeneity. Based on multiple agency theory, we predict that dedicated institutional owners and family owners are positively related to CSR performance, whereas transient institutional owners have negative influence. Our initial results support our predictions.

4 - Redirecting Attention: Overcoming the Illegitimacy Discount

Eric Yanfei Zhao, University of Alberta, 2-24 Business Building, U. of Alberta Business School, Edmonton, AB, T6G 2R6, Canada, ericy.f.zhao@gmail.com, Michael Lounsbury

How can organizations spanning rigid categories solve the dilemma of sameness and difference and gain attention and favorable evaluation from audiences? In this paper, we argue that organizations can deploy cultural resources such as name to overcome audience inattention and legitimacy deficit due to category spanning. We tested and found support for this proposition using a sample of films released in the U.S. market between 1982 and 2007.

■ SB47

47- North 230- CC

Traffic Control Schemes and Application I

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Yang Cheng, Research Associate, University of Wisconsin-Madison, 2204 Engineering Hall, Madison, WI, 53706, United States of America, cheng8@wisc.edu

1 - Equity Based Real Time Traffic Signal Control at Network Level using Historical Delay Information: An Application of Vehicle-to-Infrastructure (V2I) Communication

H. M. Abdul Aziz, PhD Student, Purdue University, 150 Arnold Drive, Apt15, West Lafayette, IN, 47906, United States of America, haziz@purdue.edu, Satish Ukkusuri

The efficiency of signal control schemes are often evaluated based on aggregate system measures only. However, efficiency does not guarantee the equity (fairness) of the system. This research proposes a signal control scheme that assures fairness (in terms of experienced intersection delay due to signal control) across the users of the system. The signal control scheme uses the historical delay information along the entire trip of the users and we propose a vehicle-to-infrastructure communication based framework for its implementation in the real world.

2 - Large Scale Traffic Signal Control: A Simulation-based Approach

Carolina Osorio, Assistant Professor, Massachusetts Institute of Technology, Room 1-232, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, osorioc@mit.edu, Linsen Chong

We propose a simulation-based optimization algorithm that efficiently solves large scale traffic signal control problems. The method is based on a metamodel approach that combines information from a detailed yet inefficient traffic simulator with information from a highly efficient and scalable macroscopic traffic model. We efficiently solve a signal control problem for the entire Swiss city of Lausanne, and derive signal plans that reduce network-wide trip travel times.

3 - Intersection Signal Optimization using Queue Length Estimation
Yang Cheng, Research Associate, University of Wisconsin-Madison, 2204 Engineering Hall, Madison, WI, 53706, United States of America, cheng8@wisc.edu, Jeff Ban, Bin Ran

By modern traffic detection technologies, traffic condition data would have higher resolution in time and space, which is especially valuable for the interrupted traffic on signalized intersections. The queue length can be estimated more easily and accurately. Therefore, this study proposes a new signal control optimization method based on queue information to improve corridor coordination. The simulation results indicate that this approach has better performance than traditional control methods.

4 - An Optimal Lane-based Signal Merge Control Model for Freeway Work Zone Operations
Yue Liu, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, WI, 53201, United States of America, liu28@uwm.edu, Jing Mao

This paper presents a dynamic control model for optimizing lane-based signal merge (LBSM) operations at freeway work zones. The control objective is to maximize the throughput. GA is employed to solve the model. Results reveal that the proposed method yields much better performance than traditional merge strategies under heavy traffic conditions.

■ SB48

48- North 231 A- CC

Integrated Supply Chain Design

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Maged Dessouky, Professor, University of Southern California, University Park Campus, Los Angeles, CA, 90007, United States of America, maged@usc.edu

1 - Near-optimal Transportation and Fair Cost Allocation in an Agricultural Supply Chain with Perishable Products
Christine Nguyen, University of Southern California, Los Angeles, CA, United States of America, nguyen7@usc.edu, Alejandro Toriello, Maged Dessouky

We consider an agricultural supply chain where several suppliers consolidate transportation of a perishable product to achieve economies of scale. Using industry data from California flower growers, we compare a practical greedy one-step lookahead policy against optimal solutions computed from a dynamic program, and determine whether transportation costs can be allocated fairly among the suppliers.

2 - Integrated Supply Chain Network Design: Location, Transportation, Routing and Inventory Decisions
Mingjun Xia, Arizona State University, 1718 S Jentilly Lane, APT 204, Tempe, AZ, 85281, United States of America, Mingjun.Xia@asu.edu, Ronald Askin

We propose a novel model to simultaneously optimize location, allocation, transportation, inventory and routing decisions in a stochastic multi-product supply chain system. Each producer provides a unique product. Each retailer has independent, random demand for multiple products. Consolidation and distribution facilities may be constructed to reduce shipment costs and increase the frequency of economical shipments. Heuristics are developed to solve large-size scale instances of the problem.

3 - Integrated Planning of Supply Chain Layout and Transportation Infrastructure Rehabilitations
Leila Hajibabai, University of Illinois at Urbana-Champaign, 205 N Mathews Avenue, Room 3142, Urbana, IL, 61801, United States of America, leila.hajibabai@gmail.com, Yun Bai, Yanfeng Ouyang

Expansion of supply chains induces considerable freight shipments between supply/demand points and intermediate facilities, which significantly accelerate highway pavement deterioration. This paper presents an analytical method to simultaneously design the supply chain as well as the pavement rehabilitation plans, which determines the optimum number and location of facilities, shipment routes, and pavement rehabilitation intensity and frequency.

4 - A Production Function-Based Empirical Analysis of Distribution Networks
Donald Warsing, Associate Professor, North Carolina State University, 2346 Nelson Hall, Raleigh, NC, 27695, United States of America, don_warsing@ncsu.edu, Michael Kay, Christian Rossetti

Using a number of public data sources, we compare distribution networks in the continental U.S. across several industry sectors. We gather data on, and/or compute from base-level data, a number of independent variables that we use as inputs to a cost function for each DC in each industry data set. This cost function serves as an important means of analyzing the variance in the input data and cost data. We present insights regarding differences in distribution strategies across industries.

5 - Designing LTL Load Plans to Mitigate Impact of Transit Time Variability
Yu Zhang, PhD Student, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30339, United States of America, zhangyu@gatech.edu, Alan Erera

We develop a method to design robust load plans for LTL carriers in order to mitigate the cost impacts of transit time variability. Load plan candidates are generated based on optimizing operations assuming that transit times take expected values, and then evaluated and refined by Monte Carlo simulation. The proposed method is applied to a case study which is built based on terminal and shipment data from a national LTL carrier.

■ SB49

49- North 231 B- CC

Joint Session TSL/SPPSN: Networks and Emergency Response

Sponsor: Transportation Science & Logistics & Public Programs, Service and Needs

Sponsored Session

Chair: Halit Uster, Industrial and Systems Engineering, Texas A&M University, College Station, TX, United States of America, uster@tamu.edu

1 - A Multi-objective Integrated Approach for Emergency Response Network Design
Jyotirmoy Dalal, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, jyotirmoy.dalal@gmail.com, Halit Uster

We consider an emergency response network design problem to determine supply locations and flows required in a large scale evacuation setting. We develop a multi-objective optimization model with generalized cost structures and proximity requirements. We present an epsilon-Costraint based approach for generating the efficient frontier and the computational results, demonstrating the efficiency of the method.

2 - Network Design for Emergency Response
Jianing Zhi, University of Alabama, 300 Alston Hall, Tuscaloosa, AL, 35487, United States of America, jzhi@crimson.ua.edu, Burcu Keskin, Sharif Melouk

We investigate a multi-period ambulance location planning problem to minimize total cost while maintaining acceptable response times. The network consists of supply centers, responder and incident locations, and hospitals. We propose two models: 1) all incidents require service in the period in which they occur, and 2) incident servicing delays are allowed but with penalty. Through experimentation, we compare these two models in terms of service quality, response time, and cost.

3 - Resilience in Passenger Transportation Networks
Reza Faturechi, PhD Candidate, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, reza@umd.edu, Elise Miller-Hooks

A bi-level stochastic program with equilibrium constraints is presented for assessing and optimizing resilience of passenger transportation networks. At the upper level, preparedness actions are taken to enhance the network or facilitate response actions, and response actions are taken post-disaster to restore system capacity. At the lower level, a partial user equilibrium is sought in which passengers choose their routes to minimize travel time given post-disaster system performance.

4 - Logistics Planning for Restoration of Network Connectivity After a Disaster
Sibel Salman, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, ssalman@ku.edu.tr, Ayse Nur Kibar

After a disaster, damaged roads should be repaired/unblocked by a fleet of machinery initially positioned in a depot to restore highway connectivity. We define a selective arc routing problem to find the walk of k vehicles with minimum time to reach connectivity. We provide a flow-based mixed integer programming model. We consider Istanbul's highway and determine the number of machinery and their initial locations under different road damage scenarios for earthquake preparedness.

■ SB50

50- North 231 C- CC

Raytheon Military Defense Applications

Sponsor: Military Applications

Sponsored Session

Chair: George Mayernik, Raytheon Integrated Defense Systems, 225 Presidential Way, Mailstop 27/2430b, Woburn, MA, 01801, United States of America, george_e_mayernik@raytheon.com

1 - Operations Analysis of a Precision Tracking Space System (PTSS) for Phased Adaptive Approach (PAA)

Daniel Wilson, Senior Principal Systems Engineer, Raytheon Integrated Defense Systems, 225 Presidential Way, Mailstop 27/2317D, Woburn, MA, 01801, United States of America, Daniel.D.Wilson@raytheon.com

The Precision Tracking Space System (PTSS) is in concept development to provide tracking for the Phased Adaptive Approach (PAA). The Space Tracking Surveillance System (STSS) demonstrated the value of Low Earth Orbit (LEO) satellites to the Ballistic Missile Defense System (BMDS). Quality of Service (QoS) metrics are being used as analytics to develop traceability from performance specifications to the mission effectiveness, system risk, and affordability of alternative BMDS architectures.

2 - Deployment Concerns and Battle Management Scheduling of Unmanned Aerial Systems

Jeffrey Schvey, Raytheon, 235 Presidential Way, Woburn, MA, 01801, United States of America, Jeffrey_E_Schvey@raytheon.com, George Blaha

In this talk, we present an overview of operations studies using a decentralized network of airborne sensors to provide missile defense engagement support. We consider deployment concerns such as basing logistics and target area coverage, as well as sensor resource scheduling during engagements to maximize system effectiveness. Results for various deployment strategies and sensor scheduling techniques are shown.

3 - Additional Ballistic Missile Defense (BMD) Considerations in a Raid Environment

George Mayernik, Raytheon Integrated Defense Systems, 225 Presidential Way, Mailstop 27/2430b, Woburn, MA, 01801, United States of America, george_e_mayernik@raytheon.com, John Krasnadevich, Michael McGowan

Recent USA Missile Defense Agency studies have involved defense of regions against multiple ballistic missile threats arriving within a specified period of time. This paper characterizes the key factors related to BMD against a raid of threats and subsequent impact on defense resources. The effect of raid size and density is shown including defense systems effectiveness in mitigating stressing raid conditions. Radar/engagement timelines and defended areas for a scenario are presented.

■ SB51

51- North 232 A- CC

Technology Solutions for Soldier Support

Sponsor: Military Applications

Sponsored Session

Chair: Tom Turner, Concurrent Technologies Corp., 747 River Road, Hollis Center, ME, 04042, United States of America, turnert@ctc.com

1 - A Proposed Analytic Method for Predicting IED Emplacements

Johnathon Dulin, Concurrent Technologies Corporation, 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com

The proliferation of Improvised Explosive Devices (IEDs) over recent years has spawned many efforts to mitigate their effects or disrupt networks; much less attention has been given to predicting emplacement. Observed environmental anomalies may suggest an IED, but improved operational planning can help keep personnel out of harm's way. By combining the strategic planning of game theory with the policy optimization of MDPs, we have the framework for a new approach in predicting IED emplacements.

2 - Representing the Power and Energy Needs of Today's Soldiers in Modeling and Simulation

Dan Rice, Technology Solutions Experts, Inc., 209 West Central St., Suite 300, Natick, MA, United States of America, daniel.rice@tseboston.com, Louisa Katlubeck, Adam Peloquin, Cortney Eldridge, Steven Yuhaski

Each piece of equipment carried increases a Soldier's load weight, potentially impacting performance and safety. Technology Solutions Experts, Inc. (TSE) used simulation tools to study the tradeoff between Soldier encumbrance and task performance. TSE created a model and Monte Carlo simulation to study the power requirements related to a Soldier's electronic equipment load weight to improve the ability to identify critical relationships between Soldier, equipment, and operational environment.

3 - The Operational Readiness Level Metric for Technology Development

Kenneth Donovan, Lockheed Martin Fellow, Lockheed Martin, 1801 State Route 17C, MD 0532, Owego, NY, 13827, United States of America, ken.b.donovan@lmco.com

Operational Readiness Level (ORL) is a proposed metric for assessing the operational maturity of a technology during the development cycle. ORL addresses a limitation of the Technology Readiness Level (TRL) metric that measures the technical maturity of an item, rather than the operational use. ORL requires early verification of the operational usage of a technology solution, thereby guiding technology development to produce items that benefit the user. Copyright 2012 Lockheed Martin Corporation.

■ SB52

52- North 232 B- CC

ENRE Award Session

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Juan Pablo Vielma, University of Pittsburgh, 1043 Benedum Hall, 3700 O'Hare Street, Pittsburgh, PA, 15261, United States of America, jvielma@pitt.edu

1 - ENRE Student Award: More to Follow

Juan Pablo Vielma, University of Pittsburgh, 1043 Benedum Hall, 3700 O'Hare Street, Pittsburgh, PA, 15261, United States of America, jvielma@pitt.edu

This session includes presentations by the winners of the 2012 student travel award and best publications in energy, natural resources and the environment. In addition the following 2011 awards will be given: -Bistra Dilkina, Best Paper Award in Forestry Sponsored Sessions; -Rodolfo Carvajal, Best Paper Award in Environment and Sustainability Sponsored Sessions; - Gonzalo Munoz and Donal O'Sullivan, Best Paper Awards in Mining Sponsored Sessions.

■ SB53

53- North 232 C- CC

Stochastic Programming in Energy

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Asgeir Tomasgard, Professor, Norwegian University of Science and Technology, Alfred getz vei 3, Trondheim, 7491, Norway, asgeir.tomasgard@iot.ntnu.no

1 - The Optimization Problem for a SmartGrid Aggregator with Multiple Markets for Flexibility

Stig Ottesen, PhD Candidate, Norwegian University of Science and Technology, Alfred getz vei 3, Trondheim, 7491, Norway, stig.ottesen@ncesmart.com, Asgeir Tomasgard

More dynamics in the power systems lead to an increasing need for operational flexibility. Traditionally only generators and large consumers have access to markets where flexibility is valued. A SmartGrid aggregator may open such markets also for demand side participation. This paper describes the aggregator role and its possible business opportunities in current market regime. A mathematical formulation of the aggregator's optimization problem is given covering different time horizons.

2 - Long Term Capacity Equilibria under Risk: A Stochastic LP Approach Extending MARKAL

Daniel Ralph, University of Cambridge Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, d.ralph@jbs.cam.ac.uk, Yves Smeers

Linear Programming, LP, is standard for modelling long term capacity equilibria, eg, MARKAL for electricity capacity, given Perfect Competition, PC. Uncertainty can be handled via expectations, ie, stochastic LP. We extend this to give an economic market interpretation of system capacity planning under risk aversion (Coherent Risk Measures). Namely, stochastic LP can be used to model capacity equilibria under risk assuming PC and financial securities are traded in a Complete Risk Market.

3 - Optimal Fuel Switching and Contract Decisions in Electricity Generation

Michael Rice, Colorado School of Mines, 816 15th St., Golden, CO, 80401, United States of America, mrice@mines.edu

The shale gas boom and proposed plant emissions regulations could accelerate a switch from coal to gas in electricity generation portfolios. We analyze optimal fuel contracts for power plants facing price and regulatory uncertainty using stochastic programming.

4 - Capacity Expansion under Uncertainty with Decison Dependent Probabilities

Asgeir Tomasgard, Professor, Norwegian University of Science and Technology, Alfred getz vei 3, Trondheim, 7491, Norway, asgeir.tomasgard@iot.ntnu.no, Lars Hellemo, Paul I. Barton

We propose an investment problem modeled as a stochastic program with decision dependent probabilities. We assume there is an activity or technology available that will alter the probabilities of the discrete scenarios occuring. By investing in such technology or activity, it is possible to increase the probability of some scenarios, while reducing the probability of the remaining scenarios. We demonstrate the use of a specialized decomposition algorithm for this class of problems.

■ SB54

54- Regency Ballroom A- Hyatt

Nicholson Student Paper Prize II

Cluster: Nicholson Student Paper Prize

Invited Session

Chair: Ashish Goel, Stanford University, Stanford, CA, United States of America, ashishg@stanford.edu

1 - American Optimal Decisions - Portfolio Safeguard (PSG): Advanced Nonlinear Mixed-Integer Optimization Package

Yi-Hao Kao,Stanford University, Stanford CA, United States of America, edward@yhkao.com, Benjamin Van Roy

We consider a problem involving estimation of a high-dimensional covariance matrix that is the sum of a diagonal matrix and a low-rank matrix, and making a decision based on the resulting estimate. Such problems arise, for example, in portfolio management, where a common approach employs principal component analysis (PCA) to estimate factors used in constructing the low-rank term of the covariance matrix. The decision problem is typically treated separately, with the estimated covariance matrix taken to be an input to an optimization problem. We propose directed PCA, an efficient algorithm that takes the decision objective into account when estimating the covariance matrix. Directed PCA effectively adjusts factors that would be produced by PCA so that they better guide the specific decision at hand. We demonstrate through computational studies that directed PCA yields significant benefit, and we prove theoretical results establishing that the degree of improvement over conventional PCA can be unbounded.

2 - Optimal Queue-size Scaling in Switched Networks

Yuan Zhong, Massachusetts Institute of Technology, 235 Albany Street, Cambridge, MA, 02139, United States of America, zhyu4118@mit.edu, Neil Walton, Devavrat Shah

We consider a switched network model, an important instance of the stochastic processing network (SPN) model (cf. Harrison [9]). The SPN model has been used successfully to model a broad spectrum of networked systems, including those arising in communications, manufacturing, transportation, inventory management, etc. The main operational issue in this model is ecient resource allocation under service constraints. We focus on online resource allocation policies, where the allocation decisions are made based on the current state and/or past history of the system. In the main result of this paper, we provide a new class of online policies that achieve optimal queue-size scaling for a class of switched networks, including input-queued switches. In particular, it establishes the validity of a long-standing conjecture (documented in [20]) about optimal queue-size scaling for input-queued switches.

3 - Heavy Traffic Approximation of Equilibria in Resource Sharing Games

Yu Wu, Stanford University, Stanford, CA, United States of America, yuwu@stanford.edu, Ramesh Johari, Luc Bui

We consider a model of priced resource sharing that combines both queueing behavior and strategic behavior. We study a priority service model where a single server allocates its capacity to agents in proportion to their payment to the system, and users from different classes act to minimize the sum of their cost for processing delay and payment. As the exact processing time of this system is hard to compute and cannot be characterized in closed form, we introduce the notion of heavy traffic equilibrium as an approximation of the Nash equilibrium, derived by considering the asymptotic regime where the system load approaches capacity. We discuss efficiency and revenue, and in particular provide a bound for the price of anarchy of the heavy traffic equilibrium.

■ SB55

55- Regency Ballroom B - Hyatt

Revenue Management and Related Applications in Emerging Economies

Cluster: Operations Research in Emerging Economies

Invited Session

Chair: Goutam Dutta, Professor, Indian Institute of Management, Production Quantitive Methods Area, Ahmedabad, Gujarat, Gu, 380015, India, goutam@iimahd.ernet.in

1 - Designing Pricing Policies for Cloud Service Providers

Megha Sharma, Assistant Professor, Indian Institute of Management Calcutta, Diamond Harbour Road, Joka, Kolkata, WB, 700104, India, megha@iimcal.ac.in, Sumanta Basu, Soumyakanti Chakraborty

Infrastructure-as-a-Service (Iaas) is expected to grow at a rapid pace in the next few years because of the flexibility offered to online platform providers in terms of meeting demand fluctuations. Pricing this service naturally becomes a critical issue for IaaS providers. We explore different pricing options for IaaS providers and their acceptance conditions for online businesses. We conclude by comparing our findings from different pricing plans and offer some guidelines on pricing IaaS.

2 - Revenue Management and Pricing for Freight Transport in Indian Railways

G Raghuram, Professor, Indian Institute of Management Ahmedabad, Wing 15, IIMA Campus, IIMA Campus, Ahmedabad, 380015, India, graghu@iimahd.ernet.in

The pricing policy for freight transport in Indian Railways demonstrates a recognition of where it is monopolistically placed, and competing with other modes. This policy is a departure from the earlier one which considered the impact of rail transport cost on the final price of the commodity. There are also a variety of discounts and surcharges depending on the traffic flows. This paper brings out the implication of the pricing policy, organizational processes behind the same and a way forward.

3 - A Mathematical Programming Approach with Revenue Management for Home Loan Pricing

Goutam Dutta, Professor, Indian Institute of Management, Production Quantitive Methods Area, Ahmedabad, Gujarat, Gu, 380015, India, goutam@iimahd.ernet.in, Deepika Thakur

We formulate a dynamic pricing model for home loans for a bank. The model optimizes the net present value of money available to the bank subject to pricing limits, cash flows. It also considers the demand price (interest rate) relationship and default probability as a function of interest rate. We then assume that different versions of demand function. We consider when demand function is given by a straight line, an exponential function and by rectangular hyperbola.

■ SB56

56- Curtis A- Hyatt

Technology Management

Contributed Session

Chair: Yuya Kajikawa, Associate Professor, Tokyo Institute of Technology, 3-3-6 Shibaura, Minato-ku, Tokyo, Japan, kajikawa@mot.titech.ac.jp

1 - Characterizing Business Models using System Dynamics

Kwanyoung Im, POSTECH, 326/4 Eng building, Hyoja dong, Pohang, Korea, Republic of, kwanyoung@postech.ac.kr, Jaehun Lee, Inyoung Koh, Hyunbo Cho

To apply the concept of a business model in real business practices, the consolidation of domain knowledge and application tools is needed. This research is aimed at reviewing the related literature and at proposing a business model application tool based on system dynamics.

2 - The Influence of Knowledge Based on Technology Collaboration

Yan Liu, Xi'an Jiaotong University, Postbox 2230, Xi'an, China, liuyan0220@stu.xjtu.edu.cn, Hong Cai

We explore how a firm's knowledge base structure influences the formation of its technological collaborating relationship. We use patent data from Chinese electrical & electronic industry from 2001 to 2008 to study the effect of firms' knowledge base on its propensity to establish technical cooperative relations. Counting data regression models show a strong link between these four properties of firm's knowledge base and the propensity to form technological cooperating relationship.

3 - Participatory Challenge Platforms: Effective Integration of Public Expertise in Organization Efforts

Tanya Kelley, Arizona State University, 411 North Central Ave., Suite 400, Phoenix, AZ, 85004, United States of America, tanya.musgrave@asu.edu, Erik Johnston, Chase Gordon

Participatory challenge platforms facilitate the integration of external individuals' personal interests and expertise into operational efforts of public and private organizations. We present results of NSF funded research on two such challenge platforms with distinct design considerations, 10,000 Solutions and The Policy Challenge. We focus on design tensions, outcomes, and how solutions are utilized by organizations. Findings suggest recommendations for future platform design and use.

4 - Multilayer Analysis of Computational Intelligence for R&D Project Design

Yuya Kajikawa, Associate Professor, Tokyo Institute of Technology, 3-3-6 Shibaura, Minato-ku, Tokyo, Japan, kajikawa@mot.titech.ac.jp

In this research, a methodology to analyze multilayer information is developed. We proposed and evaluated relatedness measures to comprehend semantic relationships between science, technology and social issues. Bibliometrics has been be used in previous works to comprehend trends of science and technology, however, have rather limited capability to support design than observation. We demonstrate that our methodology can support design of new R&D projects.

■ SB57

57- Curtis B- Hyatt

Topics in Queueing Models

Contributed Session

Chair: Jayakrishnan Nair, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, ujk@caltech.edu

1 - A Fluid Model for the Multi-class Network Queues with Time-varying Arrivals and Routing Paths

Beixiang He, North Carolina State University, Raleigh, NC, 27695, United States of America, bhe@ncsu.edu, Yunan Liu

We introduce and analyze a fluid queue network with multiple customer classes, non-Markovian patience and service distributions, time-varying arrival rates and staffing level, and deterministic routing paths. Unlike the traditional Markovian (or proportional) routing, customers are routed according to their own service paths inside the network in a deterministic fashion. We provide an efficient algorithm to compute all standard performance functions, such as the queue lengths and waiting times.

2 - Modeling Cross Correlation with Markovian Arrival Processes

Sunkyo Kim, Professor, Ajou University, San 5, Suwon, Korea, Republic of, sunkyo@ajou.ac.kr

We consider a generalization of modeling cross correlation in decomposition approximation of queueing networks. The cross correlation between randomly split streams is accounted for in the second and third moments of the merged process which is approximated as a two-state Markovian arrival process.

3 - Stabilizing Policies for Matching Portals

Burak Buke, The University of Edinburgh, School of Mathematics, King's Buildings, JCMB, Edinburgh, United Kingdom, B.Buke@ed.ac.uk, Miklos Rasonyi, Hanyi Chen

The portals, which match the people who provide a specific service with the people who demand the service, are becoming increasingly popular. In this talk, we assume that customers and suppliers arrive at the portal according to independent Poisson processes. Each customer can match with a specific supplier with a given probability independent of other suppliers and customers. We show that such a system is unstable if uncontrolled and suggest control policies to ensure stability.

4 - When Heavy-tailed and Light-tailed Traffic Compete: Response Time Tail versus throughput Optimality

Jayakrishnan Nair, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, ujk@caltech.edu, Krishna Jagannathan, Adam Wierman

We study a setting in which a heavy-tailed flow and a light-tailed flow compete for service from a single server. In this setting, the classical max-weight policy, while throughput optimal, induces heavy-tailed delays for the light-tailed flow. We prove that by careful design of intra-queue and inter-queue scheduling policies, one can achieve throughput optimality and light-tailed delays for the light-tailed flow, without affecting the delay tail for the heavy-tailed flow.

■ SB58

58- Phoenix East- Hyatt

Network Science

Sponsor: Applied Probability

Sponsored Session

Chair: David Goldberg, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, dgoldberg9@isye.gatech.edu

1 - Distributed Storage for Intermittent Energy Sources: Control Design and Performance Limits

Yashodhan Kanoria, PhD Candidate, Stanford University, 350 Serra Mall, Stanford, CA, 94305, United States of America, ykanoria@stanford.edu, David Tse, Baosen Zhang, Andrea Montanari

The power output of renewable energy sources like wind and solar varies with time and location. Two strategies have been proposed to manage this variability: 1) energy storage systems to average over time; 2) distributed generation to average over location. We introduce a network model to study the optimal use of storage and transmission resources, and propose a control design methodology. For specific network topologies we show asymptotic optimality and analytically quantify performance.

2 - Temporal Load Balancing for Distributed Backup Scheduling

Peter van de Ven, Postdoc, IBM, Yorktown Heights, NY, United States of America, petermvandeven@gmail.com, Angela Schoergendorfer, Bo Zhang

We consider users that generate traffic to be transferred to a centralized backup server across a data network. Users have time-varying connectivity due to working hours, and backup attempts are initiated locally, without knowledge of the status of other users or the network load. The backup schedule is characterized by hourly backup probabilities, and we discuss how to choose the backup probabilities so as to stabilize the system and minimize the network costs.

3 - Neighborly Measures for Sampling Independent Sets

David Goldberg, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, dgoldberg9@isye.gatech.edu

We study a family of measures which generalizes the well-known hardcore model for sampling the independent sets (i.s.) of a graph. In our model, the probability assigned to a given i.s. depends not only on its cardinality, but also on how many excluded nodes are adjacent to exactly k nodes belonging to the i.s. for each k. We give tight conditions for correlation decay in the infinite regular tree under a log-convexity assumption, and gain further insight through a perturbative analysis.

■ SB59

59- Phoenix West- Hyatt

Models for Online Content and Advertising Markets

Sponsor: Applied Probability

Sponsored Session

Chair: Assaf Zeevi, Columbia Business School, New York, NY, United States of America, assaf@gsb.columbia.edu

1 - Buy-it-now or Take-a-chance: A Mechanism for Real-time Price Discrimination

Hamid Nazerzadeh, Marshall School of Business, University of Southern California, Los Angeles, CA, United States of America, hamidnz@marshall.usc.edu, Elisa Celis, Greg Lewis, Markus Mobius

Increasingly sophisticated consumer tracking technology allows advertisers to reach narrowly targeted consumer demographics. Such targeting improves the match quality between advertisers and users, but can also result in thin markets. Using historical bidding data from a large advertising exchange, we show that there is often a substantial gap between the highest and second highest willingness to pay. With this motivation, I present a simple sequential screening mechanism.

2 - Learning Overlapping Community Structure in Social Networks: The Leader-follower Algorithm

Tauhid Zaman, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA, United States of America, zlisto@mit.edu, Devavrat Shah

We present the leader-follower algorithm (LFA) for learning overlapping community structure in social networks. It requires no input parameters and has a run-time linear in the network size. We prove that it has good performance on certain network structures which we show exist in real social data. We also find that the LFA can exactly recover the true overlapping community structure for many real social networks while more common methods fail.

3 - Telling the "Hot" from the "Not": Online Content Recommendations on the Internet
Yonatan Gur, Columbia Business School, New York, NY, United States of America, ygur14@gsb.columbia.edu, Omar Besbes, Assaf Zeevi

A new class of online services allows publishers to direct readers to other web-based content they may be interested in. We study this dynamic recommendation problem, focusing on challenges introduced by the massive stream of new content and the short shelf-life of articles, and focusing on topic-based popularity as basis for recommendations. Work is based on collaboration with a leading provider of online content recommendations.

■ SB60

60- Remington- Hyatt

Predictability and Resource Allocation Decisions in Air Traffic Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Shervin Ahmad Beygi, Lead Operations Research Analyst, Metron Aviation Inc., 45300 Catalina Ct, Dulles, VA, 20166, United States of America, shervin.ahmadbeygi@metronaviation.com

1 - Performance-based Ground Delay Program Decision-making using Multiple Criteria : Single Airport Case
Yi Liu, University of California, Berkeley, 107 McLaughlin Hall, Berkeley, CA, 94720, United States of America, liuyi.feier@gmail.com, Mark Hansen

We develop performance metrics for capacity, efficiency and predictability, and show how these metrics may be traded off in the design of Ground Delay Program (GDP) under capacity uncertainty. We link the performance to the decisions on GDP clearance time and the scope of the program. This capability allows the service provider to make performance-based GDP decisions using multiple criteria.

2 - Airline Voting Mechanisms for Parameter Selection for Air Traffic Flow Management (ATFM) Initiatives
Vikrant Vaze, Member Research Staff, Philips Research North America, 345 Scarborough Road, Briarcliff Manor, NY, 10510, United States of America, vikrant.vaze@philips.com, Cynthia Barnhart

Parameter selection for ATM initiatives is performed by the regulators while taking airline preferences into account. We design a voting scheme which can replace current ad-hoc methods. Strategic behavior is modeled using an integer programming formulation which explicitly accounts for tie-breaking rules. We solve for a Nash equilibrium using best response heuristics. We evaluate equilibrium properties including existence, uniqueness, convergence, system optimality and pareto optimality.

3 - Flight Cancellation Behavior and Delay Savings Estimates
Michael Seelhorst, University of California Berkeley, 1710 Delaware St., Berkeley, CA, 94703, United States of America, mseelhorst@berkeley.edu, Mark Hansen

A discrete choice model was used to infer airline flight cancellation preferences from a sample of on-time performance flight data. The predicted cancellation probabilities were then used as inputs to delay savings estimates, which were approximated with a continuous technique. The results from this work will be useful for incorporating flight cancellation decisions into system-wide delay forecasting models.

■ SB61

61- Russell- Hyatt

Airport/Airline Operations Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Ahmed Ghoniem, Assistant Professor, University of Massachusetts Amherst, 121 Presidents Dr., Amherst, MA, 01003, United States of America, aghoniem@isenberg.umass.edu

1 - Enhanced Column Generation for Multiple-runway Aircraft Sequencing Problem
Farbod Farhadi, Doctoral Student, University of Massachusetts Amherst, Isenberg School of Management, 121 Presidents Drive, Amherst, MA, 01003, United States of America, ffarhadi@som.umass.edu, Ahmed Ghoniem

We address mixed mode multiple-runway aircraft sequencing problem. An MIP formulation is enhanced with valid inequalities and symmetry-defeating constraints. An alternative set partitioning problem is solved by column generation using multiple algorithmic features that accelerate the convergence and tighten the duality gap.

2 - Aircraft Rescheduling under Operation Disruptions
Mohamed Kharbeche, Postdoctoral Associate, Qatar University, Mechanical and Industrial Engineering, Doha, 2713, Qatar, mkharbec@qu.edu.qa, Ameer Al-Salem, Ahmed Ghoniem, Hanif D. Sherali

We address optimization models for multiple-runway aircraft sequencing problems under operation disruptions, namely, aircraft delays, new aircraft arrivals and flight cancellations. Extensive computational results are reported for exact as well as heuristic methods.

3 - An Integrated Approach for Airline Flight Scheduling, Fleet Assignment, and Aircraft Routing
Ki-Hwan Bae, Virginia Polytechnic and State University, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, kbae04@vt.edu, Hanif D. Sherali, Mohamed Haouari

We propose a model that integrates certain aspects of the schedule design, fleet assignment, and aircraft routing processes, while considering various modeling features. Maintenance routing decisions as well as through-flight opportunities are additionally incorporated in our model, and we apply a series of different solution techniques to handle the large-scale model formulation, reduce its complexity, and enhance its solvability.

4 - Environmental Value of Optimal Separation in Continuous Descent Arrivals
Heng Chen, Isenberg School of Management, 121 Presidents Drive, University of Massachusetts, Amherst, MA, 01003, United States of America, heng@som.umass.edu, Senay Solak

Optimal separation in continuous descent arrivals (CDA) refers to the use of spacing policies that are shown to be optimal based on stochastic dynamic models. These models involve optimization of different objective structures defined as functions of runway utilization and airline operating costs. Considering some potentially implementable objective structures, we derive both analytical and numerical results that quantify the environmental value of using optimal separation policies in CDA.

■ SB62

62- Borein A - Hyatt

Joint Session Auctions/MSOM: Auctions and Procurement

Sponsor: Auctions & Manufacturing & Service Oper Mgmt

Invited Session

Chair: Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu

Co-Chair: Sang Won Kim, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, skim14@gsb.columbia.edu

1 - Production Cost Forecasts and Procurement Efficiency in Supply Chains
Tunay Tunca, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ttunca@rhsmith.umd.edu

We study the role supplier cost forecasting under upstream competition in supply chain procurement and examine the implications on market and channel performance. We derive a channel competitiveness measure that combines the forecast information structure in the supply chain with upstream channel fragmentation and study its relationship with supply chain efficiency. We show that such a measure can be a better indicator of supply chain performance compared to traditional measures.

2 - Analysis of the Vickrey-Clarke-Groves (VCG) Mechanism in Combinatorial Auctions
Sang Won Kim, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, skim14@gsb.columbia.edu, Jay Sethuraman, Gabriel Weintraub

Recent theoretical works show that the VCG mechanism can have undesirable properties, such as low revenues, in combinatorial auction settings. In contrast, recent empirical work shows the opposite for a specific important application. In this work, we develop new theoretical results for VCG mechanism that explain this apparent paradox. More broadly, we show when VCG is expected to perform well in applications and when it does not.

3 - Bundled Procurement for (Free) Technology Acquisition and Future Competition

Leon Chu, University of Southern California, Los Angeles, CA, United States of America, leonyzhu@usc.edu, Yunzeng Wang

We study the effectiveness of a procurement mechanism of a buyer that bundles the product procurement with the technology acquisition. It turns out that each supplier has a dominant offering strategy for the technology provision that only depends on the technology difference of the suppliers and the ratio between the current project size and the future market size. We find that a ratio of 10% is sufficient for the suppliers to offer the best technologies for most reasonable market conditions.

4 - Procurement Auctions with Error-prone RFQs

Yan Yin, University of Michigan, Ann Arbor, MI, United States of America, yinyan@umich.edu

Many requests for quotes (RFQs) contain errors that will trigger re-design (and windfall supplier profits) after production has begun. We study how the buyer's payment changes in the error rate, supplier's design knowledge, and competition intensity. Surprisingly, we find that a higher error rate can sometimes decrease the buyer's total payment by mitigating supplier windfall profits. We also show "pre-paying" re-design costs can be an alternative strategy to stem windfall profits.

■ SB63

63- Borein B- Hyatt

Worker and Consumer Behaviors

Contributed Session

Chair: Corey Kiassat, PhD Candidate, University of Toronto, Faculty of Applied Science & Engineering, 5 King's College Road, Toronto, M5S 3G8, Canada, ckiassat@mie.utoronto.ca

1 - Hiring An Envy-free Secretary is Costly

Nguyen Truong, IEOR PhD Student, University of California-Berkeley, 2414 Dwight Way #6, Berkeley, CA, 94704, United States of America, nltruong@berkeley.edu

We consider the minimum expected rank secretary problem, where it is well known that the optimal stopping mechanism selects an applicant with rank ≈ 3.8695. This mechanism, however, may not deliver intended results: early (late) applicants wish to delay (move to earlier) their interviews. In order for each applicant to not envy any other's position, the optimal expected rank of the hired applicant is shown to be $\Omega(\ln(n))$. As such, it is costly to have envy-free participants.

2 - Consumer Behavior Analysis in a Convenient Store Based on Shopping Path Data

Chenqu Luo, Master Student, Department of Industrial Engineering, Tsinghua University, Building Shunde Room South 607, Beijing, 100084, China, luocq11@mails.tsinghua.edu.cn, Lefei Li

The consumers' shopping path indicates much to their shopping behaviors. We develop a utility function that describes consumers' preference on the next movement and use Beyesian method for estimation. Statistics show the shopping behavior in a convenient store is quite different from that in a supermarket. Moreover, we can identify typical path patterns that are closely related to the consumers' target products and visiting time, which potentially support the managers' category decisions.

3 - Enhancing System Performance through Failure Risk Analysis from a Worker Characteristic Perspective

Corey Kiassat, PhD Candidate, University of Toronto, Faculty of Applied Science & Engineering, 5 King's College Road, Toronto, M5S 3G8, Canada, ckiassat@mie.utoronto.ca, Dragan Banjevic

We want to perform a failure risk analysis to enhance system performance. We are specifically interested in the effect of worker characteristics on failure risk. In the case of failures caused by workers, the Decision Maker (DM) must intervene to mitigate the risk. We develop a revenue model, using the proportional hazards model, to provide the DM with a cost-benefit analysis, balancing the advantage of risk reduction against the direct cost of the intervention method.

4 - Intrapersonal Heterogeneity in Intertemporal Choice Behavior: Evidence

Sasha Bartashnik, Memorial Sloan-Kettering Cancer Center, 405 Lexington Avenue, 3rd Floor, New York, NY, 10174, United States of America, bartasha@mskcc.org, Paul Kattuman

We examine whether the traditional binary classification of individuals into dynamically consistent exponential or present-biased quasi-hyperbolic discounters is absolute using De Nederlandsche Bank Household Survey data. Most individuals are internally heterogeneous. Intrapersonal heterogeneity is significant and fairly stable over time. Our results have significant implications for enhancing individual and societal welfare via individualized choice architectures, particularly in healthcare.

■ SB66

66- Ellis West- Hyatt

Joint Session DM/QSR: Sensor-based Health Informatics

Sponsor: Data Mining & Quality, Statistics and Reliability

Sponsored Session

Chair: Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Spatiotemporal Change Detection Methods in Non-homogeneous Change Size

Sung Won Han, Fellow, Hoffmann-La Roche Inc., 340 Kingsland St., Nutley, NJ, United States of America, sung_won.han@roche.com, Seoung Bum Kim, Kyu Jong Lee, Hua Zhong

In the classical change point detection problem, the change pattern is homogeneous over time and space, and the change size is sustained after the change. However, in practical spatotemporal health care surveillance, the underlying assumptions of problems are more complicated. Change size can be various over space, so the change size can be large at the center of outbreak but small at the edge. We investigate the existing methods to see how they perform under the complex cases.

2 - Localization of Myocardial Infarction using Vectorcardiogram Octant Transition Network

Trung Le, Oklahoma State University, 322 Engineering North, Stillwater, Ok, 74075, United States of America, trung.le@okstate.edu, Satish Bukkapatnam

Myocardial Infarction is a leading cause of death in the US. Detecting the location of MI in the early stages can significantly improve treatment efficiency and reduce mortality risks. We present an approach that uses the topological features of octant network reconstructed from VCG signals to detect and localize MI. Extensive tests using data of from Physionet indicate that transition features can differentiate healthy, inferior, anterior MI with >92% sensitivity and >93% specificity.

3 - Multiscale Adaptive Basis Function Modeling of Spatiotemporal Signals

Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

Mathematical models facilitate the characterization and recognition of underlying biological patterns. However, there are practical issues pertinent to model efficacy, robustness, and generality. This paper presents a multiscale adaptive basis function approach to model space-time cardiac pathological behaviors, using the "best matching" projections of characteristic waves onto a dictionary of nonlinear basis functions. The model performance is experimentally evaluated with real-world signals.

4 - Developing a Healthcare Cost Index using Advanced Analytics

Dursun Delen, Professor, Oklahoma State University, 700 N. Greenwood Ave., Tulsa, OK, 74106, United States of America, dursun.delen@okstate.edu, James Hess

Due to high variability, cost of healthcare has become one of the largest risk factors for today's businesses. Establishment of a practical healthcare commodity index provides the pathway to transparency, which allows businesses to trade healthcare cost futures, and ultimately creates the open market environment necessary to encourage and support competitive pricing. This presentation focuses on the overall process of developing (based on data and analytics) such a healthcare cost index.

■ SB67

67- Ellis East- Hyatt

System Reliability and Maintenance

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Nan Chen, Assistant Professor, National University of Singapore, Department of Industrial and Systems Eng, 1 Engineering Drive 2, Singapore, 129789, Singapore, isecn@nus.edu.sg

1 - Criticality Index for Degrading Components under Dynamic Environments

Xiao Liu, liuxiaodnn_1@hotmail.com, Khalifa N. Al-Khalif, Dingguo Hua, Abdel Magid Hamouda, David Coit, Elsayed Elsayed

Criticality index of a component depends on its degradation path and system configuration. This presentation investigates the criticality analysis for degrading components under dynamic environmental conditions. The component degradation is modeled by a k-dimensional Wiener process, and component fails when any of these k degradation paths attains its own threshold level. In the numerical examples, we illustrate the computation of component criticality in different system configurations.

2 - A Quantile Regression Approach to Analyze Accelerated Life Testing Data

Nan Chen, Assistant Professor, National University of Singapore, Department of Industrial and Systems Eng, 1 Engineering Drive 2, Singapore, 129789, Singapore, isecn@nus.edu.sg

We propose a quantile regression framework to model the accelerated life tests (ALT) data. The quantile of the failure distribution at usage level can be easily estimated. Compared with traditional parametric regression methods, quantile regression is distribution free, efficient in presence of censoring, and is more flexible in modeling ALT relations. In addition, the method can be used naturally in the cases when the failure-free life depends on the accelerating factor.

3 - An Integrated Approach to the Design of Statistically Precise and Energy Efficient Accelerated Tests

Haitao Liao, Associate Professor, University of Arizona, Tucson, AZ, 85721, United States of America, hliao@email.arizona.edu, Dan Zhang

In this paper, an integrated experimental design approach is introduced with the objective of maximizing the reliability estimation precision while minizing the energy consumption of an accelerated test. Relevant statistical inference methods and required experimental needs and technologies are discussed.

4 - Reliability and Maintenance for Dependent Competing Failure Processes with Shifting Thresholds

Qianmei Feng, Associate Professor, Houston University, E206 Engineering Bldg 2, Houston University, Houston, TX, 77204-4008, United States of America, qmfeng@uh.edu, Lei Jiang, David Coit

We present reliability and maintenance models for systems subject to multiple dependent competing failure processes with a changing and dependent failure threshold. Three cases of dependency between shock process and hard failure threshold level are studied. Reliability models are developed based on degradation and random shock modeling. Two preventive maintenance policies are also applied and compared. Then an MEMS example is given to demonstrate the reliability models and maintenance polices.

■ SB68

68- Suite 312- Hyatt

Finance: Risk Management

Contributed Session

Chair: Woojin Chang, Seoul National University, Gwanak-gu Gwanak-ro 1, Seoul, Korea, Republic of, changw@snu.ac.kr

1 - Continuous Dynamic Portfolio Choice with Bayesian Regret

Shea Chen, University of California, Berkeley, 301 Main St., Unit 34E, San Francisco, CA, 94105, United States of America, sheachen@berkeley.edu, Andrew Lim

We formulate a continuous-time portfolio choice problem in which the investor is uncertain about parameters of the model, and the objective function is a Bayesian version of relative regret. The optimal portfolio is characterized and shown to involve a "tilted" posterior, where the tilting is defined in terms of a family of stochastic benchmarks.

2 - Forecasting the Stress of Credit Card Portfolios

Mee-chi So, University of Southampton, Southampton Management School, Southampton, SO17 1BJ, United Kingdom, m.so@soton.ac.uk

This study aims to develop models to forecast the default rate of credit card accounts under different economic scenarios. Two modelling approaches were extended to include the impact of lenders's actions within the model. The first approach was a regression model of the aggregate losses based on economic variables. The second approach was a set of vintage level models which highlighted the months on books effect on credit losses. A case study using the models was described.

3 - Credit Rating Migration Model: Markov Switching Process

Woojin Chang, Seoul National University, Gwanak-gu Gwanak-ro 1, Seoul, Korea, Republic of, changw@snu.ac.kr, Sung Yeol Oh

We develop a credit rating migration model based on a discrete-time discrete-valued Markov process depending on hidden Markov chain. We also present a parameter estimation procedure for the proposed model using the EM algorithm. The likelihood ratio test shows that our model depending on hidden Markov chain better describes the credit rating dynamics than a benchmark Markov chain model.

4 - A Model for Dynamic TaxCredit Utilization

Nilofar Varzgani, PhD Student, Rutgers University, Rutgers Business School, Newark, NJ, 07102, United States of America, nilofarv@pegasus.rutgers.edu, Suresh Govindaraj, Michael Katehakis

We develop a new stochastic dynamic programming model for dynamic tax credit utilization for a firm that provides maximum expected benefit over a rolling horizon. The model takes into account earnings and profits, net operating losses, and credit carryovers. We present computation to demonstrate the benefit the model provides.

■ SB69

69- Suite 314- Hyatt

Data Driven Portfolio Optimization

Cluster: Optimization in Finance

Invited Session

Chair: Victor DeMiguel, Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, avmiguel@london.edu

1 - Computing General Arbitrage Bounds for European Basket Options via Dantzig-Wolfe Decomposition

Luis Zuluaga, Assistant Professor, Lehigh University, 200 West Packer Ave., Bethlehem, United States of America, luis.zuluaga@lehigh.edu

We study the problem of computing bounds on the price of a basket option given the only assumption of absence of arbitrage, and information about prices of other basket options. We provide a simple way to compute this type of bounds via a suitable Dantzig-Wolfe decomposition. We illustrate our results by computing upper and lower arbitrage bounds on gasoline/heating oil crack spread options, and Alternative Risk Transfer (ART) products.

2 - Performance-based Regularization in Mean-CVaR Portfolio Optimization

Gah-Yi Vahn, Assistant Professor, London Business School, Regent's Park, London, United Kingdom, gvahn@london.edu, Noureddine El Karoui, Andrew Lim

We introduce performance-based regularization (PBR), a new approach to addressing estimation risk in data-driven optimization, to mean-CVaR portfolio optimization. We assume the available log-return data is iid, and detail the approach for two cases: nonparametric and parametric (the log-return distribution belongs in the elliptical family). We show that the PBR methods produce efficient frontiers that are, on average, closer to the population efficient frontier with less variability.

3 - Size Matters: Optimal Calibration of Shrinkage Estimators for Portfolio Selection

Alberto Martin-Utrera, Mr, University Carlos III of Madrid, C/ Madrid, 126-28903, GETAFE, Sp, 28903, amutrera@est-econ.uc3m.es

We carry out a comprehensive investigation of shrinkage estimators in the context of portfolio optimization and we make several contributions to this field. First, we propose new shrinkage estimators for both the moments of asset returns and portfolio weights. Second, we propose novel calibration criteria to compute the optimal shrinkage intensity. Finally, we propose a parametric and a nonparametric approach to estimate the shrinkage intensity.

■ SB70

70- Suite 316- Hyatt

Economics of Information Systems

Sponsor: Information Systems

Sponsored Session

Chair: Wael Jabr, Assistant Professor, University of Calgary, 2500 University Dr NW, Calgary, AB, T3A6L5, Canada, wjabr@ucalgary.ca

1 - Are Online Seller Recommendations Biased? An Empirical Investigation of OTA Hotel Listings

Ori Marom, RSM Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, omarom@rsm.nl, Roman Peskin

Online travel agents such as Expedia and Priceline.com often have tremendous power to direct online buyers to a small subset of available products. Our paper investigates whether OTA selections of top-listed hotels can be regarded as biased from buyers' viewpoint. Our empirical investigation indicates that that while OTA websites provide buyers with valuable search assistance by locating good-valued deals they also influence them to purchase relatively expensive products.

2 - Social Media and Firm Equity Value

Jie Zhang, University of Texas Arlington, 701 S West St., Arlington, TX, 76019, United States of America, jiezhang@uta.edu, Xueming Luo

Companies have advocated social media to engage consumers and gauge product market performance. We empirically examine whether social media metrics are related to firm equity value. The results from the developed time-series models suggest that social media-based metrics (blogs and reviews) have higher predictive value for firm stock market performance compared to web traffic and search. We also find that firm stock performance responds faster to the social media-based metrics.

3 - Learning under Ambiguity: An Experiment

Yaroslav Rosokha, PhD Student, The University of Texas at Austin, 2225 Speedway Stop C3100, Austin, TX, 78712-1690, United States of America, yaroslav.rosokha@gmail.com, Othon Moreno Gonzalez

We design and conduct an economic experiment to compare the learning process of the agents under risk and ambiguity. Decisions are made in conjunction with a sequence of draws (with replacement), allowing us to track beliefs over time. We estimate: (1) Bayesian updating allowing for base rate fallacy; (2) Bayesian updating with multiple priors; and (3) Reinforcement Learning. Our findings suggest that new signal in is over-weighted more in risky than in ambiguous environments.

4 - The Role of Online Reviews in Mitigating Product Uncertainties

Wael Jabr, Assistant Professor, University of Calgary, 2500 University Dr NW, Calgary, AB, T3A6L5, Canada, wjabr@ucalgary.ca, Mohammad Rahman

User reviews are widely recognized as an important resource that customers rely on to help guide their purchases. This paper evaluates the efficiency of the market for information at reducing the uncertainty of consumers. We use Bayesian Belief and Information Gain to quantify such efficiency. We then show that the market design for information release plays a major role in affecting this efficiency. We investigate the evolution of reviews and corresponding efficiencies and market design issues.

■ SB71

71- Suite 318- Hyatt

Digital and Social Networks I

Sponsor: eBusiness

Sponsored Session

Chair: Jui Ramaprasad, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3H2V1, Canada, jui.ramaprasad@mcgill.ca

1 - Celebrity Effect? An Empirical Study of Social Influence and Online Product Review Behavior

Mingfeng Lin, University of Arizona, 1130 E. Helen St., Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu, Paulo Goes

We study the effect of consumers' online interactions on their product review behaviors. A popular form of users' online interaction is the "subscription" model that gives priority to contents generated by the person subscribed to. Using a panel dataset from epinions.com, we examine how users' product review behaviors evolve as their online followership – peers who are silent – grows. Our results have implications for research on word-of-mouth and user-generated content (UGC) sites in general.

2 - Are Paid Subscriptions on Music Social Networks Contagious?

Ravi Bapna, Professor, University of Minnesota, 321 19th Avenue South, 55410, Minneapolis, MN, 55455, United States of America, rbapna@umn.edu, Akhmed Umyarov

In this paper, we present a novel randomized experiment that tests the existence of causal peer influence in the general population of a particular large-scale online social network. Both simple t-test and logistic regression indicate that user's adoption of a product causes her online friends to pay for it and adopt it as well.

3 - Exploring the Role of Cultural Differences in Crowd-funder Contribution Decisions

Gordon Burtch, Temple University, 1810 N 13th Street, Speakman Hall 201F, Philadelphia, PA, 19122, United States of America, gburtch@temple.edu, Anindya Ghose, Sunil Wattal

Contrary to Thomas Friedman's Flat World hypothesis, here, we argue that the world is by no means flat, as distance continues to exist along dimensions other than the physical. Many online marketplaces today offer participants the opportunity to engage in economic exchange with others the world over. As a result, the differences between parties are often striking. Bearing this in mind, we explore the impact of cultural differences on lending on the world's largest micro-finance website, Kiva.org. Leveraging an aggregate dataset of country-to-country lending, incorporating three million lending actions over a five-year period, we find that cultural differences are negatively associated with lending and, interestingly, that this association is decreasing in physical distance (we interpret this as an awareness effect). We consider the implications of this finding for the purveyors of globalized online marketplaces, making recommendations regarding information presentation and the application of institutional trust mechanisms.

■ SB72

72- Suite 322- Hyatt

OR Applications in Cloud Computing

Cluster: Cloud Computing

Invited Session

Chair: Emrah Zarifoglu, Optimization Scientist, IBM, 1 Franklin Parkway, Building 910, San Mateo, CA, 94402, United States of America, emrah.zarifoglu@utexas.edu

1 - Pricing Differentiated Services in Cloud Computing Market

Linna Du, PhD Student, University of Connecticut, School of Business, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, linna.du@business.uconn.edu

The cloud computing market is featured as a large scale market for a non-storable commodity with instantaneously released capacity, differentiated services, stochastic demands and risk-averse vendor. We employ queueing network analysis to capture the system unique features and long run behavior. Our model helps business managers develop actionable pricing strategies for increasing the revenue rate, controlling the user's service adoption and hedging against variability in realized services.

2 - Stochastic Scheduling for Cloud Computing

Laurent Pauwels, The University of Sydney, Rm 481, Merewether Building, Sydney, Australia, laurent.pauwels@sydney.edu.au, Dmytro Matsypura

We consider a scheduling problem of a software-as-a-service provider (cloud user). The provider has access to virtually unlimited computing resources on a pay-as-you-go basis. The jobs that need to be scheduled have uncertain sizes and completion times. We present stochastic program formulations with respect to various measures of optimality, investigate structural properties of optimal solutions and analyze worst-case performance of various heuristics.

3 - An Analytical Approach to Solving Load Balancing Problem in Cloud Computing

Emrah Zarifoglu, Optimization Scientist, IBM, 1 Franklin Parkway, Building 910, San Mateo, CA, 94402, United States of America, emrah.zarifoglu@utexas.edu, Ilyas Iyoob

The dynamic cost structure increases the importance of intelligent provisioning and management in cloud computing. We develop an optimization model to decide high-mark utilization and low-mark utilization values to turn on and off VMs while minimizing provisioning and maintenance costs. Solving the same optimization problem at different points in time provides us with a dynamic VM load balancing policy. The robustness of the policy relies on the agility of periodical model corrections.

■ SB73

73- Suite 324- Hyatt

Market Microstructure and High-Frequency Trading

Cluster: Quantitative Finance

Invited Session

Chair: Gerry Tsoukalas, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States of America, gtsouk@wharton.upenn.edu

1 - General State Space Models in Electronic Market Making

Vibhav Bukkapatanam, PhD Candidate, Stanford University, 1410 Huang Engineering Center, Stanford, CA, 94305, United States of America, vibhav@stanford.edu

In recent years, the dramatic growth in electronic trading has revolutionized financial markets and led to the proliferation of high frequency market makers. In this work, we analyze how general state space models can be used in several key components of a maket making system, including spot variance and correlation estimation, regime switching modeling of high frequency data and optimal inventory control based bid-ask spreads estimation.

2 - Predicting the Impact of a Proposed Securities Exchange Regulation

Waraporn Tongprasit, Stanford University, Stanford, CA, United States of America, Waraporn@stanford.edu, Benjamin Van Roy

We propose an approach to counterfactual analysis of securities exchanges that can be applied to predict the impact of proposed regulatory changes. We conduct an empirical case study in which we predict the impact of a historical tick size change on exchange efficiency and compare predictions to what can be inferred from subsequent data.

3 - Disentangling Price Impact from Alpha

Mehmet Saglam, Columbia University, New York, NY, United States of America, MSaglam13@gsb.columbia.edu, Ciamac Moallemi, Michael Sotiropoulos

Motivated by the performance measurement literature in active portfolio management, we are interested in attributing the price changes observed during an execution of a large trade between the client's short term predictive ability, alpha view, and the broker's price impact. Using execution data with a large universe of clients, we show that incorporating client's alpha view drastically increases the explanatory power of existing models and enables to accurately estimate the price impact.

4 - Optimal Trade Execution using Limit Order Book Information

Rolf Waeber, Cornell University, 206 Rhodes Hall, Ithaca, NY, 14853, United States of America, rw339@cornell.edu, Sasha Stoikov

We consider an asset liquidation problem at the market microstructure level, given observations of the limit order book. The optimization is formulated in terms of a sequence of stopping times, at which we submit market sell orders. We describe the shape of the trade and no trade regions for different price and latency assumptions. In the empirical section, we show that our policy signicantly outperforms a benchmark TWAP algorithm on US treasury bonds.

Sunday, 1:30pm - 3:00pm

■ SC01

01- West 101- CC

Optimization in Data Mining

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu

1 - How to Reverse-Engineer Quality Rankings

Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Michael Cavaretta, Gloria Chou, Robert Thomas, Allison Chang

A good or bad product quality rating can make or break an organization. However, the notion of "quality" is often defined by an independent rating company that does not make the formula for ranking products public. We provide a machine learning approach for "reverse-engineering" a rating company's proprietary model as closely as possible.

2 - A Probabilistic Model for Assessing the Mortality Risk in Post-operative Patients

Dmytro Korenkevych, 372 Maguire Village, Apt. 1, Gainesville, FL, 32603, United States of America, dmitriy@ufl.edu, Petar Momcilovic, Panos Pardalos

We used a probabilistic model based on Bayesian learning and optimization techniques to estimate the mortality risk in post-operative patients. The model incorporates discrete and continuous risk factors and provides a probabilistic score associated with the risk. The feature selection procedure was applied in order to discard irrelevant risk factors and 70/30 cross-validation analysis was performed to estimate the accuracy of the model.

3 - Information-Theoretic Learning for Stimulus-specific Clustering with fMRI

Chun-An (Joe) Chou, University of Washington, 3900 Stevens Way, Seattle, WA, United States of America, joechou@uw.edu, Kittipat "Bot" Kampa, Art Chaovalitwongse

Multi-Voxel Pattern Analysis (MVPA) is a popular approach for cognitive recognition with functional MRI (fMRI), as it is consistent with a neural system that mental operations/representations are instantiated in a neural population code spanning multiple voxels. In this work, we employ an unsupervised clustering with an information-theoretic measure to identify the spatial patterns of voxels in response to stimuli. The results illustrate that there are specific clusters for different stimuli.

4 - Optimization Models for Predicting the Antigenic Variants of Influenza A/H3N2 Virus

Serdar Karademir, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, United States of America, sek73@pitt.edu

We use the pairwise amino acid sequence comparison of influenza strains and the antigenic distance between each pair as input for a classification model to identify immunodominant positions that cause antigenic variety. The performance of the model is evaluated through cross validation where cross validation is modeled as an optimization program that minimizes the misclassification error. Comparison to results of existing classification methods in literature is also provided.

■ SC02

02- West 102 A- CC

DA Entrepreneurs Speak: Challenges and Opportunities in Building Decision Analysis Based Businesses

Sponsor: Decision Analysis

Sponsored Session

Chair: Chris Dalton, CEO, Syncopation Software, 6 State Street, Suite 402, Bangor, ME, 04401, United States of America, cdalton@syncopation.com

1 - Tales from the Decision Analysis Industrial Complex

Chris Dalton, CEO, Syncopation Software, 6 State Street, Suite 402, Bangor, ME, 04401, United States of America, cdalton@syncopation.com

This talk will define what it means to be a Decision Analysis based business, and give examples of successful and unsuccessful DA business models. At the end of the session, we will have a panel discussion with the speakers and other members of the DA business community.

2 - Building Decision Analysis Based Businesses

Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

As an early member of the original Decision Analysis Group at SRI Internaional and then one of the founders of SDG, I have participated in and observed about a dozen of start-up companies based on the power of DA. In this session, I will share my observations from the successes and failures of these entrepreneurial efforts.

3 - Business Analytics, Information Technology, and Decision Analysis

Don Kleinmuntz, Exec VP & Cofounder, Strata Decision Technology, 200 E Randolph St 49th Floor, Chicago, IL, 60601, United States of America, dnk@strata-decision.com

Business Analytics is a huge wave that has overtaken a number of industries and is guiding the development of IT infrastructure in many others. There is a genuine opportunity to embed decision analysis tools and processes in that infrastructure and create tremendous impact.

4 - Panel Discussion: Challenges and Opportunities for DA Businesses

Moderator: Chris Dalton, CEO, Syncopation Software, 6 State Street, Suite 402, Bangor, ME, 04401, United States of America, cdalton@syncopation.com, Panelists: Carl Spetzler, Don Kleinmuntz, Terry Bresnick, Jack Kloeber

The speakers and other members of the DA business community will discuss the present business environment, taking questions from the audience as time allows.

■ SC03

03- West 102 B- CC

Decision Models in Public Health

Sponsor: Decision Analysis

Sponsored Session

Chair: Ozgur Araz, Assistant Professor, University of Nebraska Medical Center, Nebraska Medical Center, Omaha, NE, 68198-4365, United States of America, ozgur.araz@unmc.edu

1 - Multiplicative Utilities for Health and Consumption

Sam Bodily, John Tyler Professor of Business Administration, University of Virginia, Darden Business School, 100 Darden Boulevard, Charlottesville, VA, 22903, United States of America, BodilyS@virginia.edu, Casey Lichtendahl

Two new multiplicative utilities offer correlation aversion and other advantages over an additive. They extend the QALY model. For constant health and consumption streams, they reduce to a double exponential utility in life duration, which can have risk aversion, decreasing absolute risk aversion, increasing relative risk aversion, as well as standard gamble probabilities (proportional time tradeoffs) that increase (decrease) in life duration and that exceed proportional time tradeoffs.

2 - Determining Optimal Therapy for Diabetic Patients. Evidence from the U.S. Department of Veteran Affairs

Vishal Ahuja, PhD Candidate, University of Chicago, Booth Business School, Chicago, IL, 60637, United States of America, vahuja@chicagobooth.edu, John Birge

We investigate various treatments for Type 2 Diabetes in adults using data from the Veterans Health Administration. We analyze dynamic patterns of glucose lowering therapies, and evaluate the risks of associated diabetes outcomes. We propose a predictive model to evaluate effectiveness of various glucose-lowering therapies and recommend optimal treatment based on patient characteristics. The paper addresses confounding measures such as physician bias and unobservable patient characteristics.

3 - Robust Design of a Cost-effective Diabetic Retinopathy Screening Program with Design of Experiments

Irene Vidyanti, University of Southern California, Los Angeles, CA, United States of America, irenevidyanti@gmail.com, Shinyi Wu

This paper demonstrates the use of Design of Experiments (DoE) coupled with simulation to design a robust and cost-effective public health intervention systematically, using the design of a Diabetic Retinopathy screening program as illustration. Optimum input factor settings are determined to find settings that achieve cost-effectiveness. Then, robust parameter design is used to find settings for a robust program by treating uncertain variables - such as screening compliance - as noise factors.

4 - Aversion to Health Inequalities in Healthcare Prioritisation: A Multiobjective Perspective

Alec Morton, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, United Kingdom, a.morton@lse.ac.uk

In this paper we discuss the prioritisation of healthcare projects where there is a concern about health inequalities. Our analysis begins with a standard welfare economic model of healthcare resource allocation and we show how the problem can be reformulated as one of finding a particular subset of the class of efficient solutions to an implied multiobjective optimization problem. We demonstrate our approach through a worked example of treatment for clinical depression.

■ SC04

04- West 102 C- CC

Decision Makers

Contributed Session

Chair: Rayan Hafiz, Engineering Specialist, Saudi Arabian Oil Company, Aramco, Dhahran, Saudi Arabia, rayan.hafiz@aramco.com

1 - Customer Experience Optimization: Regaining Control of the Conversation

Theresa Igharo, GPJ @ IBM, 11301 Burnet Rd., Austin, United States of America, igharot@us.ibm.com

Today's consumers have higher expectations of personalization while leaving tremendous volumes of seemingly unrelated digital 'fingerprints' across many locations. Organizations have been relying on ad-hoc, inefficient and disconnected set of processes to make crucial decisions; with often, no means to understand the impact of those decisions. Business analytics accessible to all decisions makers increases operational agility while providing organizations with actionable customer insights.

2 - Deciding by Feeling or Calculation

Mark Schneider, University of Connecticut, Uconn School of Business, 81 Cheney Drive, Storrs, CT, United States of America, mschneider@business.uconn.edu, Robin Coulter

Affective and cognitive processes are widely recognized to play an important role in decision making. However, it remains unclear whether general features of a decision problem can systematically cue one set of processes over another. In this paper, we introduce and evaluate a mechanism for predicting whether people will rely on feeling or calculation in a decision task.

3 - Optimizing Portfolios when Dealing with Ranges

Siddhartha Sampath, Arizona State University, 849 W Elna Rae, Tempe, AZ, United States of America, Siddhartha.Sampath@asu.edu, Esma Gel, John Fowler, Karl Kempf

We attempt to discuss the product portfolio selection process and demonstrate how to solve a non-linear knapsack problem when various products have their values interdependent on each other. When each value of benefit and cost is also a range the problem is made even harder. We discuss various strategies to address this problem.

4 - Decoy Effects in Ethical Decision Making

Wenjie Tang, Assistant Professor, IE Business School, Calle de Maria de Molina, 12, Piso 5, Madrid, Spain, wenjie.tang@ie.edu, Steffen Keck

We study decoy effects in ethical decision making. Decoys are alternatives whose presence increases preference for another alternative in the choice set, though themselves rarely chosen. We consider a scenario where one is facing a choice between a monetary more beneficial alternative and a more ethical one. We propose that the presence of decoys make one more likely to choose the ethical alternative. We believe that such method can be used to induce ethical choice in various contexts.

5 - Decision Analysis at Work: Making the Case for Strategic Technology Selection

Rayan Hafiz, Engineering Specialist, Saudi Arabian Oil Company, Aramco, Dhahran, Saudi Arabia, rayan.hafiz@aramco.com

In this work, we develop a decision analysis model to help the upper management make the strategic decision for an emerging technology's companywide adoption. Such modeling will help understanding the impact of the decisions related to dealing with the targeted technology and will set the corporate direction dealing with it for the next 10 years.

■ SC05

05- West 103 A- CC

Condition-based Maintenance Optimization

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Hao Peng, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612WN, Netherlands, h.peng@tue.nl

1 - A Condition-Based Maintenance Policy for Multi-Component Systems with High Setup Cost of Maintenance

Qiushi Zhu, Ir.MSc, TU Eindhoven, De Lismortel, Paviljoen E.9a, Eindhoven, 5612 AR, Netherlands, q.zhu@tue.nl, Geert-Jan van Houtum, Hao Peng

We propose a new CBM policy for multi-component systems with stochastically and continuously deterioration. To reduce the setup cost of maintenance, a joint maintenance interval is proposed. The optimal maintenance interval and control limits of components are determined by minimizing the average long-run cost rate related to maintenance and downtime. Moreover, a numerical study with a case of wind farm maintenance is performed based on a large number of non-identical components.

2 - Health Condition Prediction Accuracy Improvement and Condition Based Maintenance Optimization

Zhigang Tian, Concordia University, 1515 Ste-Catherine Street West, Montreal, Canada, tian@ciise.concordia.ca, Bairong Wu

Health condition prediction is a key part for condition based maintenance (CBM). It is observed that the prediction accuracy improves with the increase of the age of the component as it approaches the failure time in many applications. In this paper, we model the relationship between the prediction accuracy and the age of a component relative to its predicted failure time. A numerical method is presented to evaluate the cost of the CBM policy.

3 - Condition-Based Maintenance for Degrading Systems under Dynamic Environments

Xiao Liu, liuxiaodnn_1@hotmail.com, Khalifa N. Al-Khalif, Abdel Magid Hamouda, Dingguo Hua, David Coit, Elsayed Elsayed

This talk presents an optimum condition-based maintenance policy for degrading systems under dynamic environments. The degradation is described by a Wiener process with both degradation rate and diffusion being influenced by system age and environment condition. We obtain the distribution of the remaining system life, based on which the dynamic CBM decisions are made.

4 - Statistical Updating of Finite Element Model with Lamb Wave Sensing Data for Structural Damage Detection

Arda Vanli, College of Engineering, Florida State University, 2525 Pottsdamer St., Tallahassee, FL, 32310, United States of America, avanli@fsu.edu, Sungmoon Jung

This study proposes a new probabilistic model updating method used to improve the prediction capability of a finite element analysis (FEA) model of structural damages with experimental observations from a sensor network. A controlled damage experiment on a composite panel showed that the proposed model updating approach achieves a prediction accuracy that is superior to existing calibration approaches.

■ SC06

06- West 103 B- CC

Advances in Simulation Optimization

Sponsor: Simulation

Sponsored Session

Chair: Jie Xu, Assistant Professor, George Mason University, 4400 University Dr, MS 4A6, GMU Engr Bldg RM2100, Fairfax, VA, 22030, United States of America, jxu13@gmu.edu

1 - Integer-ordered Simulation Optimization using R-SPLINE

Bruce Schmeiser, Professor, Purdue University, West Lafayette, IN, 47905, United States of America, bruce@purdue.edu, Honggang Wang, Raghu Pasupathy

We consider simulation-optimization problems where the decision variables are integer ordered. We develop R-SPLINE—-an algorithm that alternates between a continuous search and a discrete neighborhood search, to asymptotically identify a local minimum. R-SPLINE converges almost surely, with exponentially decaying likelihood of returning an incorrect solution. With no parameter tuning, R-SPLINE compares favorably with existing algorithms.

2 - Rare Event Simulation for Processes Generated via Stochastic Fixed Point Equations

Jeffrey Collamore, Associate Professor, University of Copenhagen, Department of Mathematical Sciences, Universitetsparken 5, Copenhagen, DK-2100, Denmark, collamore@math.ku.dk, Anand Vidyashankar, Guoqing Diao

Stochastic fixed point equations (SFPEs) arise in a wide variety of applications in, e.g., insurance, finance, and the analysis of algorithms. A general SFPE has the form V =_d f(V) (=_d denotes equality in distribution), where the objective is very often to infer the tail probabilities of V. We present a general importance sampling algorithm for computing these rare event probabilities, establishing efficiency, optimality, and sharp estimates for the running time.

3 - The Gradient Oriented Polar Random Search

Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, iseleelh@nus.edu.sg, Haobin Li, Ek Peng Chew

Involving gradient information in a random search is believed to have better performance than both gradient-based and metaheuristic local search. However, the main difficulty is to incorporate and control randomness in a direction instead of a point. This paper makes use of generalized polar coordinates and corresponding random distributions, so as to design a brand new Gradient Oriented Polar Random Search (GO-POLARS) that is proved to satisfy the conditions for strong local convergence.

4 - Gradient-based Adaptive Stochastic Search for Discrete Optimization

Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, University of Illinois, Urbana, 61801, United States of America, enluzhou@illinois.edu, Xi Chen

We propose a stochastic search algorithm to solve discrete optimization problems by iteratively generating candidate solutions from a sequence of parameterized sampling distributions over the solution space. We convert the discrete optimization problem to an equivalent continuous problem on the parameter space so that a gradient method can be incorporated to update the parameter of the sampling distribution. We show the convergence of the algorithm via tools from stochastic approximation.

■ SC07

07- West 104 A- CC

Joint Session Data Mining/Computational Stochastic Optimization: Towards Statistical Parsimony in Adaptive Dynamic Programming

Sponsor: Data Mining & Computational Stochastic Optimization

Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Department Ind. & Manuf. Sys. Engr., Arlington, TX, United States of America, vchen@uta.edu

1 - Adaptive Value Function Approximation for Continuous-State Stochastic Dynamic Programming

Prashant Tarun, Assistant Professor, Craig School of Business, Missouri Western State University, St. Joseph, MO, 64507, United States of America, ptarun@missouriwestern.edu, Huiyuan Fan, Victoria Chen

This study presents a sequential method of value function approximation in the high-dimensional, continuous-state dynamic programming framework. This method can adaptively determine both sample size and model structure. Furthermore, we introduce two new algorithms that help implement the adaptive value function approximation method efficiently.

2 - Deterministic Sampling Designs with Local Methods for Optimization Problems

Danilo Macciò, National Research Council of Italy, Via De Marini 6, Genova, 16149, Italy, ddmach@ge.issia.cnr.it, Victoria Chen, Cristiano Cervellera, Diana Martinez

The problem of numerically minimizing a functional cost involves the following issues: (i) the definition of a sampling of the domain where the functional is evaluated; (ii) the choice of a class of models to approximate the solution. This work presents a comparison of performances among several deterministic sampling designs (low-discrepancy sequences, orthogonal arrays and Latin hypercubes) in case local models are employed, in different functional optimization contexts.

3 - Sequential MARS for Optimization Problems
Diana Martinez, The University of Texas at Arlington, 415 Summit Ave., Apt # 213, Arlington, TX, 76013, United States of America, diana.martinezcepeda@mavs.uta.edu, Victoria Chen, Jay Rosenberger

To find a solution for optimization problems, in some cases an iterative method to sequentially reduce the solution space is required. It is possible then to have different design configurations for testing that involve the estimation of a response value. MARS modeling technique has been used as a surrogate method in such cases. An algorithm that proposes different MARS sequential routines has been developed and tested.

4 - Global Optimization for a Piecewise Linear Regression Spline Function
Nadia Martinez, The University of Texas at Arlington, 415 Summit Ave. Apt. No. 213, Arlington, TX, 76013, United States of America, nadia.martinezcepeda@mavs.uta.edu, Jay Rosenberger, Victoria Chen, Diana Martinez

In this research, we optimize a piecewise linear version of a Multivariate Adaptive Regression Spline (MARS) function subject to constraints that include both linear regression models and piecewise linear MARS models. A mixed integer programming (MIP) model is developed and solved using branch-and-bound. The MIP is adjusted to enable flexibility to handle both continuous and categorical variables. This method is demonstrated on designing an automotive safety system for a major US automaker.

■ SC08

08- West 104 B- CC

Joint Session Doing Good with Good OR/SPPSN: Doing Good with Good OR Competition: Finalist Presentations II

Cluster: Doing Good with Good OR Student Competition & Public Programs, Service and Needs

Invited Session

Chair: Susan Martonosi, Harvey Mudd College, Department of Mathematics, Claremont, CA, United States of America, martonosi@hmc.edu

1 - Resource-based Patient Prioritization in Mass-casualty Incidents
Alex Mills, Indiana University Kelley School of Business, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, millsaf@indiana.edu, Nilay Argon, Serhan Ziya

Mass-casualty triage currently relies on a fixed priority ordering among different classes of patients and does not explicitly consider resource limitations. The nominated study separates medical classification from prioritization and incorporates survival probabilities and resource limitations. Based on analytical and simulation results, additional lives can be saved by using the proposed policies to support decisions made by medical providers.

2 - Improving Patient Access to Surgical Care at the Juravinski Hospital through Informed Decision Making
Daphne Sniekers, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, daphne.sniekers@mail.utoronto.ca

A generic simulation-based perioperative decision support tool was implemented at the Hamilton Health Sciences Juravinski Hospital to demonstrate how changes to the operating room schedule and resource availability affect patient flow. The tool was used in negotiations with the various stakeholder groups in order to come to consensus on changes to implement. The tool provided invaluable support in their decision-making.

3 - using Simulation Methods to Guide Decision Making of the Kentucky Cabinet for Health and Family Services
Russell Harpring, University of Louisville, Louisville, KY, United States of America, russ.harpring@gmail.com

The purpose of this study is to find potential improvements to the intake process at the Kentucky Cabinet for Health and Family Services (KCHFS) main office in Louisville using simulation software. KCHFS deals with hundreds of clients every day, with each client in the system having different needs. By simulating the process with Arena Software, experiments can be run with real-time data and solutions found to complex problems involving process flow, staffing, and layout.

■ SC09

09- West 105 A- CC

Evolutionary Multi-Criterion Optimization Tutorial

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Kalyanmoy Deb, Professor, Indian Institute of Technology Kanpur, Department of Mechanical Engineering, Kanpur, UP, 208016, India, deb@iitk.ac.in

1 - Statistical Stopping Criteria for a Multiobjective Genetic Algorithm
Natalia Viktorovna, Analytics Consultant, SAS Institute, 100 Sas Campus Drive, T6059, Cary, NC, 27513, United States of America, natalia.viktorovna@sas.com, Reha Uzsoy, Juan Gaytan

In this research we explore the data structure at iterations of a genetic algorithm. Main objective is the generation of a statistical stopping criterion. We fit a multivariate distribution to objective function values and estimate the probability of creating new non-dominated solutions. This probability is used as a stopping criterion in a modified NSGA II aimed at solving the Multicriteria Project Scheduling Problem. Computational experimentation was developed to test the criteria performance.

2 - A Tutorial on Evolutionary Multi-criterion Optimization (EMO)
Kalyanmoy Deb, Professor, Indian Institute of Technology Kanpur, Department of Mechanical Engineering, Kanpur, UP, 208016, India, deb@iitk.ac.in

For the past two decades, multi-criterion optimization problems have been increasingly being solved using evolutionary optimization methods, simply due to their parallel search and ability to find multiple trade-off solutions in a single simulation. In this tutorial, we shall present principles of EMO, results on a number of challenging problems and highlight some recent research challenges.

■ SC10

10- West 105 B- CC

Probabilistic Constrained Problems with Continuous Random Variables

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Andras Prekopa, Professor, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, 08854, United States of America, prekopa@rutcor.rutgers.edu

1 - Convex Approximations in Stochastic Programming by Semidefinite Programming
Istvan Deak, Professor, Department of Computer Science, Corvinus University of Budapest, Hungary, istvan.deak@uni-corvinus.hu, Imre Polik, Andras Prekopa, Tamás Terlaky

The following question arises in stochastic programming: how can one approximate a noisy convex function with a convex quadratic function that is is optimal in some sense. Using several approaches for constructing convex approximations we present some optimization models yielding convex quadratic regressions that are optimal approximations in L_1, L_2 and L_infinity norm. Extensive numerical experiments to investigate the behavior of the proposed methods are also performed.

2 - Serially Linked Water Reservoir Network Design
Olga Myndyuk, RUTCOR, Rutgers University, United States of America, olik.myn@gmail.com

In this paper, we find optimal reservoir capacities such that at least k consecutive periods the demands are met in the course of a given number of periods with a probability which is greater than or equal to the prescribed probability. Formulation, mathematical properties and the solution methodology of the model are given. Numerical example for 2 reservoirs with 8 consecutive out of 24 periods is presented for the model with demand and inflow being normally distributed random variables.

3 - Solution of a Probabilistic Constrained Stochastic Programming Problem with Random Technology Matrix
Andras Prekopa, Professor, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, 08854, United States of America, prekopa@rutcor.rutgers.edu

We formulate and solve a probabilistic constrained problem, where some of the technology coefficients are normally distributed random variables. The method of solution combines the supporting hyperplane method and one, originally designed to solve problems with discrete random variables. Closed form formulas for the gradient and numerical results will be presented.

4 - Simultaneous Confidence Intervals for Future Values of a Stochastic Process

Jinwook Lee, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jinwook@rci.rutgers.edu, Andras Prekopa

Given a stochastic process with known finite dimensional distributions, we construct lower and upper bounds for the probability that future values of the stochastic process run within prescribed limits. For the solution of the problem we use the technique of the univariate and multivariate discrete moment problem. Applications and numerical example will be presented.

■ SC11

11- West 105 C- CC

Application of Stochastic Programming II

Contributed Session

Chair: Aaron L. Nsakanda, Associate Professor, Carleton University, 1125 Colonel By Drive, Ottawa, ON, K1S5B6, Canada, aaron_nsakanda@carleton.ca

1 - Application of Multistage Stochastic Programming Modeling and Solution Method on Capacity Planning

George Kolomvos, European Dynamics S.A, 209, Kifisias Av., Athens, Greece, kolomvos@gmail.com, Georgios Saharidis

We address the problem of capacity planning in a gas distribution network under uncertain demand and prices. We consider a large number of scenarios claiming to describe as good as possible the space of demand and prices for gas. We model the problem as a multistage stochastic problem, where the decision on the first stage variables - capacities - will have a critical impact for all future stages. The problem is solved using the nested decomposition method.

2 - Solving the Drift Control Problem

Melda Ormeci Matoglu, Ozyegin University, Kusbakisi Cad No 2, Altunizade, Istanbul, Turkey, melda.ormeci@ozyegin.edu.tr, John Vande Vate

We model managing capacity as a Brownian drift control problem. We formulate an LP and develop a bound for the continuous problem from a dual solution to the discrete problem. Showing the equivalence between strongly feasible bases and deterministic unichain policies, we combinatorialize the pivoting process and solve the LP without computing its coefficients. We develop scheme analogous to column generation to drive the gap between the discrete approximation and the continuous problem to zero.

3 - Time Consistency and Risk Averse Dynamic Decision Models: Interpretation and Practical Consequences

Davi Valladão, IBM Research/PUC-Rio, Av. Pasteur, 138/146 Botafogo, Rio de Janeiro, Brazil, davimv@br.ibm.com, Alexandre Street, Birgit Rudloff

We discuss a CVaR based portfolio selection problem and compare a time consistent formulation to an inconsistent one. We develop a new way of measuring the impact of an inconsistent policy on the objective function. We present a sensitivity analysis by computing this impact for different planning horizons and risk aversion levels. Finally, we develop a suitable economic interpretation for its recursive objective function based on the certainty equivalent of the related preference function.

4 - Contracts with Options in Loyalty Reward Programs Supply Chain

Aaron L. Nsakanda, Associate Professor, Carleton University, 1125 Colonel By Drive, Ottawa, ON, K1S5B6, Canada, aaron_nsakanda@carleton.ca, Yuheng CAO, Moustapha Diaby

We explore the issue of whether an option mechanism is a viable alternative to help hedge against demand uncertainties in a Loyalty Reward Programs enterprise-led supply chain. A two-stage stochastic linear programming with simple recourse model is developed as well as a solution procedure based on the sampling average approximation scheme. Our preliminary numerical result will be reported.

5 - Optimal Control of Production-inventory Systems with Multiple Facilities

Mohsen Elhafsi, Professsor, University of California, School of Business Administration, Riverside, CA, 92521, United States of America, mohsen.elhafsi@ucr.edu, Xi Chen

We study a single-product production-inventory make-to-stock system with identical production facilities with no order cancellations. Demand is backlogged if not satisfied immediately. The objective is to control the number of production facilities to be used at as well as the inventory level so as to minimize the total production, holding and backlog costs. We show that the optimal policy is defined by a set of inventory levels and a set of facilities activate-up-to levels for facilities.

■ SC12

12- West 106 A- CC

Approximate Dynamic Programming and Discrete Optimization

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Alejandro Toriello, Assistant Professor, Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, toriello@usc.edu

1 - Patient Admission and Scheduling under Multiple Resource Constraints

Christiane Barz, Assistant Professor, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, United States of America, christiane.barz@anderson.ucla.edu, Kumar Rajaram

We consider a patient admission problem to a hospital with multiple potential bottlenecks (e.g. beds and OR). While there is an uncontrolled arrival process of emergency patients, the hospital has the freedom to postpone or even reject the admission of non-emergency patients. We model the control process as a Markov Decision Process and suggest price-directed heuristics.

2 - Dynamic Software Release Management

Angelo Mancini, PhD. Student, University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, United States of America, amancini@chicagobooth.edu, Dan Adelman

Software release management is the process by which firms decide on the timing, composition and development schedule of their future releases. We construct a semi-Markov decision process (SMDP) that models these decisions in the presence of a stochastically improving competitor. We then formulate the static problem as a mixed integer nonlinear program, whose parameters we obtain by making a value function approximation in our SMDP. We report numerical results.

3 - Computing Bounds and Solutions to the Traveling Salesman Problem with Approximate Linear Programming

Michael Poremba, PhD. Student, Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave., GER 240, Los Angeles, CA, 90089, United States of America, poremba@usc.edu, Alejandro Toriello

We study the asymmetric traveling salesman problem (TSP) using approximate linear programming (ALP) to restrict the dynamic programming formulation. The second author has previously applied ALP to the TSP to obtain a nested family of polyhedral lower bounds. We discuss two computational methods for solving these formulations, constraint generation and a primal-dual procedure. We also present a price-directed tour generation algorithm that uses ALP solutions as approximate costs-to-go.

4 - A Dynamic Traveling Salesman Problem with Stochastic Arc Costs

Alejandro Toriello, Assistant Professor, Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave., GER 240, Los Angeles, CA, 90089, United States of America, toriello@usc.edu, William Haskell, Michael Poremba

We propose a dynamic TSP with stochastic arc costs and use approximate linear programming to obtain a semi-infinite linear programming lower bound. The bound requires only expected costs and the support set, and is valid for any distribution with these parameters. Though NP-hard for general support sets, we show that the bound can be solved efficiently for polytopes with polynomially many extreme points and hyper-rectangles. We analyze the price-directed policy and derive performance guarantees.

■ SC13

13- West 106 B- CC

Mathematical Programming and Applications

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Hande Benson, Associate Professor, Drexel University, Department of Decision Sciences, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

1 - High-contrast Imaging via Fast Fourier Optimization

Robert Vanderbei, Professor, Princeton University, Operations Research & Financial Engineer, 209 Sherrerd Hall, Princeton, NJ, 08544, United States of America, rvdb@princeton.edu

Many interesting and fundamentally practical optimization problems involve constraints on the Fourier transform of a function. Because the fast Fourier transform is recursive, it is difficult to embed into a linear optimization problem. However, one can adapt the main idea behind the fast Fourier transform so as to make it encodable as constraints in an optimization problem. We demonstrate on a real-world problem from the field of high-contrast imaging.

2 - Incorporation of Delivery Times in Gamma Knife(R) Perfexion(TM) Treatment Optimization

Hamid Ghaffari, PhD Candidate, University of Toronto, 5 King's College Rd, MIE Department, Toronto, ON, M5S 3G8, Canada, ghaffari@mie.utoronto.ca, Mark Ruschin, Dionne Aleman, David Jaffray

Although the use of mathematical optimization techniques can greatly improve the quality of treatment plans in various radiation therapy treatment settings, one complication is the potentially clinically unrealistic nature of optimized treatments. The difficulty arises from two factors: (1) machine limitations that govern the minimum amount of radiation delivery time, and (2) long treatment times due to the complexity of optimized treatments. In the first scenario, if a particular configuration of the radiation delivery device is used, then it typically must deliver radiation for a minimum length of time. Incorporation of such requirements in a mathematical model generally requires additional constraints and binary variables, increasing the difficulty of the optimization. In the second scenario, mathematically optimized treatments commonly assign (small amounts of) radiation to be delivered from many configurations, drastically increasing the time needed to deliver the treatment (beam-on time). We examine these two issues within the penalty-based sector-duration optimization model for Gamma Knife(R) Perfexion(TM) (Elekta, Stockholm, Sweden) and the combined sector-duration and isocentre optimization model to reduce beam-on time and to ensure that machine limitations regarding delivery times are met.

3 - Portfolio Optimization with Cone Constraints and Discrete Decisions

Umit Saglam, Drexel University, LeBow College of Business, Philadelphia, 19104, United States of America, us26@drexel.edu

We consider a portfolio optimization problem where the investor's objective is to choose a trading strategy that maximizes expected return penalized by transaction costs. We include portfolio diversification constraints in our single and multiperiod models. The overall problem is a mixed-integer second-order cone programming problem, which we solve with the Matlab-based solver MILANO. This talk will focus on the solution and warm-start of the second-order cone programming subproblems.

4 - MILANO: Mixed-Integer Linear and Nonlinear Optimizer

Hande Benson, Associate Professor, Drexel University, Department of Decision Sciences, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

We will present the primal-dual penalty interior-point method that is implemented in MILANO for providing warmstart capabilities and robustness in a linear and mixed-integer linear programming framework. Extensions to cone programs and nonlinear programming problems will be explored.

■ SC14

14- West 106 C- CC

Applications of Project Management

Contributed Session

Chair: Hiroko Nakamura, Project Researcher, The University of Tokyo, 7-3-1 Hongo Bunkyoku, Tokyo, Japan, techhn@mail.ecc.u-tokyo.ac.jp

1 - Change's Timing and Cost Discrepancies in Public Project Procurement

Jane Park, The George Washington University, 2201 G Street NW Duques Hall, Washington, DC, 20052, United States of America, janepark@gwu.edu

The purpose of this study is to help manage changes better in public project procurement. Using the data from transportation projects in Florida, this study classifies the reasons of change order and investigates how differently each reason affect the cost discrepancy between the original contract amount and the final payment depending on its timing of occurrence over the project duration.

2 - A Study to Identify Key Factors Influencing Cost Overruns in Medium-scale Infrastructural and Social Projects

Mohamed Salem, Senior Civil Engineer Specialist, Islamic Development Bank-Special Assistance Division, P.O. Box: 5925, Jeddah, 21432, Saudi Arabia, msalm@isdb.org, Alaa Elwany, Hamdy Elwany

The accuracy of cost estimation for infrastructural and social projects is one of the key challenges that faces governments and funding organizations. Cost estimates during feasibility studies involve many assumptions and inherent uncertainties. The study analyzed the key factors that contribute to cost escalation. In particular, the study used multiple regression analysis to develop an empirical formula for accurately predicting cost overrun/ underrun during the project implementation. The study is based on analyzing data from 110 real-world projects implemented over the past decades.

3 - Solving the Resource Investment Problem with Time Lags (RIP/max) via Mixed Integer Programming

Juan D. Palacio, Instructor, Universidad de los Andes, Departamento de Ingenieria Industrial, Carrera 1 Este # 19 A-40, Bogota, Colombia, jd.palacio34@uniandes.edu.co, Sebastian Brunal, Andrés L. Medaglia

The RIP/max is an NP-Hard problem that has been solved mainly using heuristics. We tackle this problem using a mixed integer programming model with proven success on variants of the project selection and resource constrained scheduling problems. We found new best known solutions and optimality certificates for instances of up to 30 projects. We also report new lower bounds and show how this formulation adapts to the resource investment problem (RIP).

4 - Survey and Evaluation of Bibliometrics Methods for Research Planning and Technology Management

Hiroko Nakamura, Project Researcher, The University of Tokyo, 7-3-1 Hongo Bunkyoku, Tokyo, Japan, techhn@mail.ecc.u-tokyo.ac.jp, Yuya Kajikawa, Shinji Suzuki

Managers and researchers of research institutes and industries were surveyed to determine the needs and expectation of bibliomentrics development for research planning and technology management. Based on actual problems, patent analysis methods to produce technology overviews of an industry and detection of emerging technology and of technology links between automobile and aviation industries were studied and evaluated.

■ SC15

15- West 202- CC

Software Demonstration

Invited Session

1 - GAMS Development Corporation – Deploying Your Application Built Around GAMS

Michael Bussieck, GAMS Development, 1217 Potomac Street NW, Washington, DC, 20007, United States of America, mbussieck@gams.com, Lutz Westermann

We will demonstrate the development of an application built around GAMS and its effortless deployment. Furthermore, we will show recent enhancements to the GAMS system.

2 -Salford Systems - Real-World Data Analysis

Mikhail Golovnya, Senior Scientist, Salford Systems, 9685 Via Excelencia, Ste. 208, San Diego CA 92126, United States of America, dsprague@schwartzmsl.com

This demo, intended for the modeler wanting to apply data mining methodology, will emphasize real-world data analysis. The main concepts behind well-known data mining algorithms will be discussed: CART®, MARS® automated non-linear regression, TreeNet® stochastic gradient boosting, RandomForests®, GPS™ Generalized Pathseeker, ISLE™ Importance Sampled Learning Ensembles and the Rulefit™ Rule Extraction Engine. We will discuss what is novel in the software, cover implementation, and show where the software fits in terms of other data mining software methods.

■ SC16

16- West 207- CC

Humanitarian Logistics

Cluster: Tutorials

Invited Session

Chair: Ozlem Ergun, Associate Professor, Georgia Institute of Technology, ndustrial and Systems Engineering, Atlanta, GA, United States of America

1 - Humanitarian Logistics

Ozlem Ergun, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, oergun@isye.gatech.edu, Pinar Keskinocak, Julie L. Swann

The increase in natural and man-made disasters in the recent years has highlighted challenging problems in humanitarian operations, in addition to major long-term humanitarian development challenges. Humanitarian logistics plays an important role in preparing for, responding to, and recovering from sudden-onset disasters and addressing long-term development issues. The management of humanitarian logistics operations involves many challenges such as conflicting objectives from multiple stakeholders, coordination and collaboration, high uncertainty, and scarcity of resources. In this tutorial, we provide an introduction to humanitarian logistics and its main application areas while outlining current research trends and the major challenges faced in the area today. We also present four decision aid tools addressing typical applications of humanitarian logistics: network design for donated human breast milk delivery in South Africa, port simulation and shipment scheduling for a large international agency, demand estimation and emergency procurement for CARE, and post-disaster medical response under accessibility issues. In presenting these decision aid tools, we aim to underline the differences in issues arising from sudden-onset disasters and long-term development problems, various stages of the life cycle of disasters, and different decision levels, while also pointing to general aspects in modeling humanitarian logistics problems.

■ SC17

17- West 208 B- CC

SpORts II

Sponsor: SpORts

Sponsored Session

Chair: Dan Finkel, Technical Staff, Massachusetts Insitute of Technology, Lincoln Laboratory, 244 Wood Street, Lexington, MA, 02420, United States of America, dfinkel@ll.mit.edu

1 - Optimizing an NBA Team's Approach to Free Agency using the Knapsack Problem

Sam Kirshner, Queen's School of Business, 143 Union Street, Kingston, Canada, skirshner@business.queensu.ca

This paper models an NBA team's approach free agency as a knapsack problem. The free agents comprise the items and the team's cap space corresponds to the size of the knapsack. As free agents are signed, both the talent pool to fill the team's needs and the money in the market decreases. Thus, the optimal free agency strategy must considers the trade-off of losing a player to a competitor and acquiring the player at a price that preserves as much cap space as possible to sign additional players.

2 - Bicycle Tours: Modeling the Perceived Exertion of a Daily Path

Katherine Carl, Graduate Associate, University of Arizona, 1130 E. Helen Street, P.O. Box 210108, Tucson, AZ, 85721, United States of America, kcarl@email.arizona.edu, Moshe Dror

Bicycling has garnered interest in recent years. Perceived exertion is an important consideration when selecting bicycling tours. We propose a model for generating measures of perceived exertion for bicycling tours for 5 categories of riders. We present results of a survey designed to verify the accuracy of our model and demonstrate a good fit with exertion values reported by cyclists.

3 - Determining NHL Player Types and Point Shares

Timothy Chan, Assistant Professor, University of Toronto, 5 King's College Rd, Toronto, Canada, tcychan@mie.utoronto.ca, David Novati

In this talk, we present a methodology using clustering, projection and regression analyses to determine distinct NHL player types and measure players' individual contributions to overall team performance. We apply our method to historical NHL player data at the season level. Initial results suggest that our point share values are aligned with perceptions of "goodness" of a hockey player. In particular, players with the highest point share values tend to win major NHL awards.

■ SC18

18- West 208 A- CC

Methodologies for Network Optimization

Contributed Session

Chair: Paul Grigas, Graduate Student, Massachusetts Institute of Technology, 23 Gorham St., Somerville, MA, 02144, United States of America, pgrigas@mit.edu

1 - Self-learning Injection-locked Laser Network for Solving NP-complete Problems

Kai Wen, Edward L. Ginzton Laboratory, Stanford University, Stanford, CA, 94305, United States of America, kaiwen@stanford.edu, Kenta Takata, Shoko Utsunomiya, Yoshihisa Yamamoto

NP-complete problems are important and difficult problems. Here we show that a novel computation machine based on injection-locked laser network and self-learning algorithm, driven by random phase noise, can solve NP-complete Ising problems in polynomial time. The stochastic simulation on MAX-CUT problems on cubic graph and the two-layer lattice problems demonstrates its polynomial time complexity up to problem size of 800 nodes.

2 - A Parallel Decomposition-based Methodology for Network Optimization

Dia St. John, INEG Department, University of Arkansas, Fayetteville, AR, 72701, United States of America, destjohn@uark.edu, Chase Rainwater, J. Cole Smith

This work focuses on the development of parallel techniques that provide computational capabilities to solve large-scale network interdiction models. By dictating the interdiction state of a subset of system arcs, each parallel iteration focuses on determining the most disruptive decisions for a subset of the network. The use of message passing between these parallel structures facilitates efficient communication between simultaneous iterations and contributes to the algorithmic effectiveness.

3 - Circuit Bases and Multicommodity Flows

J N Hagstrom, Professor, University of Illinois at Chicago, Information & Decision Sciences, 601 S Morgan, Chicago, IL, 60607-7124, United States of America, hagstrom@uic.edu

We show that a basis for a capacitated multicommodity flow on a graph can be identified as a set of spanning trees, one for each commodity and one for the slacks, plus a circuit basis of the graph, with each circuit assigned to a single commodity or to the slacks. Work is in progress to develop a simplex algorithm implementation using this new insight.

4 - An Algorithm for Convex Non-separable Network Flow Problems

Trung Hieu Tran, Research Fellow, National University of Singapore, Industrial and Systems Engineering Dept, 1 Engineering Drive 2, Singapore, 117576, Singapore, isetth@nus.edu.sg, Kwong Meng Teo

While algorithms for multi-commodity network flows often assume linear or convex separable costs, non-separability is often a more realistic assumption. We propose a modified gradient projection-based algorithm for this more general class of problems, and present its performance using standard test cases. Empirical studies also show that a convex non-separable network flow problem can be handled if the same problem, but with linear cost, can be solved using CPLEX.

5 - Proximal Subgradient and Dual Averaging for Sequential Decision-making and Non-smooth Optimization

Paul Grigas, Graduate Student, Massachusetts Institute of Technology, 23 Gorham St., Somerville, MA, 02144, United States of America, pgrigas@mit.edu, Robert Freund

We analyze and show interconnections between prox subgradient and dual averaging methods for both sequential decision making and non-smooth convex optimization. Our sequential decision-making problem generalizes the problem addressed in the Hedge Algorithm as studied by Baes and Burgisser, and our framework provides a new interpretation and extensions of the algorithm AdaBoost. Lastly, we examine connections between various first-order method, and propose new first-order methods as well.

■ SC19

19- West 211 A- CC

Joint Session Healthcare Logistics/SPPSN: Routing Problems in Healthcare Operations II

Cluster: Healthcare Logistics & Public Programs, Service and Needs

Invited Session

Chair: Burcu Keskin, University of Alabama, Alston Hall, Box: 870226, Tuscaloosa, AL, 3587-0226, United States of America, bkeskin@cba.ua.edu

1 - A Multi-level Location-allocation Problem in Human Milk Banking Network Expansion

Melih Çelik, Georgia Institue of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, melihcelik@gatech.edu, Wenwei Cao, Nadia Viljoen, Julie L. Swann, Ozlem Ergun

Motivated by a project on a human milk bank reserve, we study a large-scale multi-level location-allocation problem for supply chain network expansion. With limited resources, equitable access to breast milk for newborn infants is one of the main concerns. We incorporate several fairness metrics into the model. Under certain metrics, the MIP becomes intractable. We develop efficient heuristics to find good solutions and conduct comparative computational analysis of different fairness metrics.

2 - Enabling Greater Access to Home Meal Delivery

Maciek Nowak, Associate Professor, Loyola University Chicago, 1 E. Pearson, Chicago, IL, 60611, United States of America, mnowak4@luc.edu, Mike Hewitt, Leonardo Gala

Meals on Wheels relies on a volunteer workforce to deliver meals to approximately one million homebound citizens in the US. One strategy for accommodating these requests is to deliver multiple (frozen) meals at a time. However, the funding agencies and the volunteers value the relationships that are developed by having a client interact with the same volunteer. We present an approach to quantify the efficiencies associated with delivering frozen meals while maintaining volunteer consistency.

3 - An Integrated Patient Transportation and Operating Room Scheduling Model

Sepehr Nemati Proon, PhD Student, University of Pittburgh, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, sen12@pitt.edu, Oleg Shylo, Andrew Schaefer, Oleg Prokopyev

We consider a model that integrates the optimal transportation of outpatients from their residences to a hospital and back using a capacitated fleet of vehicles, and surgery scheduling in an operating suite. The objective is to minimize the overall time that patients spend on the road and in the hospital. We formulate this problem as a mixed integer programming and present a Branch and Price algorithm to solve it.

4 - Integrated Dispatch and Relocation Model to Minimize Emergency Vehicle Response

Ibrahim Capar, University of Alabama, Tuscaloosa, AL, United States of America, icapar@cba.ua.edu, Burcu Keskin, Sharif Melouk

To prepare for emergency events, EMS managers must address issues related to emergency vehicle dispatching and relocation. We use an MIP formulation to model emergency vehicle dispatching and relocation with the goal of minimizing incident response time while still maintaining adequate network coverage. We conduct extensive experimentation to examine model performance and glean managerial insights.

■ SC20

20- West 211 B- CC

Software Demonstration

Invited Session

1 - Spry, Inc. – The Analyst Workbench: Better Data, Faster Decisions

Todd Jones, Director of Business Solutions, Spry, Inc., Director of Business Solutions, Sparks, MD, 21152, United States of America, tjones@spryinc.com

A single hub of integrated data, one that can be sliced however an analyst wants. The ability to quickly add and integrate new data sources; the ability to use R, Tableau and other familiar tools. These are the demands of today's analyst. This presentation will introduce the role semantic technologies and big data play in developing this data hub.

2. - Oracle - Learn About Oracle Crystal Ball

Michael Franden, Academic & Higher Education Sales Mgr, Oracle, 500 Oracle Parkway, Redwood Shores, CA, 94065, United States of America, michael.franden@oracle.com

Oracle's Crystal Ball software is a spreadsheet-based software suite for predictive modeling, forecasting, Monte Carlo simulation and optimization. Crystal Ball is used in universities and schools worldwide to teach financial risk analysis, valuation, engineering, portfolio allocation, cost estimation, and project management. Join us for an overview of Crystal Ball and our teaching resources.

■ SC21

21- West 212 A- CC

Modeling and Optimization Techniques for Network Robustness

Sponsor: Optimization/Networks

Sponsored Session

Chair: Vladimir Boginski, Assistant Professor, University of Florida, 1350 N. Poquito Rd, Shalimar, FL, 32579, United States of America, boginski@reef.ufl.edu

1 - Reliable Routing under Independent Random Arc Failures and Algorithms with Scenario Reduction

Qipeng Zheng, Assistant Professor, West Virginia University, Industrial & Management Systems Engineer, P.O. Box 6070, Morgantown, WV, 26505, United States of America, qipeng.zheng@gmail.com, Daniel Simmons

Routing problems have been widely researched in literature. Of particular interest to this talk is on the stochastic cases of routing, which consider the risk of route failures. This talk proposes stochastic programming models for routing problems under independent arc failures. We propose methods which study the dual of the stochastic programs when the routes are given, and generate efficient cuts for the original problem to avoid complete enumeration of all outcomes.

2 - Modeling and Analysis of Generalized Path-Restricted Robust Network Clusters

Alexander Veremyev, NRC Research Associate, Air Force Research Laboratory, Building 13, 101 West Eglin Boulevard, Eglin AFB, FL, United States of America, averemyev@gmail.com, Vladimir Boginski

Short path connectivity between each pair of nodes is an essential network property in different real-life settings. A k-club may not reflect certain path-connectivity requirements, i.e, some important pairs of network components may be required to have shorter communication paths than others, or to be dependent on the cluster size. Several possible generalizations of a k-club concept and new compact linear 0-1 programming models for identifying such network clusters are discussed in this talk.

3 - Optimal Design and Augmentation of Strongly Attack-Tolerant Two-Hop Clusters in Directed Networks

Grigory Pastukhov, PhD Student, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, gpastukhov@ufl.edu, Eduardo Pasiliao, Vladimir Boginski, Alexander Veremyev

We consider the problems of minimum-cost design and augmentation of directed network clusters that have diameter 2 and maintain the same diameter after the deletion of up to R nodes and/or arcs anywhere in a cluster. We present provably tight theoretical bounds and a heuristic algorithm for the considered class of problems. Computational experiments suggest that the proposed heuristic does identify high-quality near-optimal solutions.

4 - Transmission Switching in Electric Grids with Uncertain Line Failures

Oleg Shirokikh, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, olegshirokikh@ufl.edu, Alexey Sorokin, Vladimir Boginski

We consider the problem of identifying a cost-efficient strategy for transmission line switching in electric grids under risk considerations associated with uncertain failures of multiple lines (arcs) in the network. Conditional Value-at-Risk constraints are utilized to restrict potential losses associated with failure scenarios.

■ SC22

22- West 212 B- CC

Service and Security

Sponsor: Telecommunications

Sponsored Session

Chair: Hu Hao, Chinese University of Hong Kong, Room 943, 9/F, Cheng Yu Tung Building, Shatin, N.T., Hong Kong, 999077, China, huhao@baf.msmail.cuhk.edu.hk

1 - A Portfolio-based Approach for the Analysis of Integrated Telecommunications Service Providers

Steven Powell, Professor Emeritus, California State Polytechnic University, Pomona, CIS Department, 3801 West Temple Avenue, Pomona, CA, 91768, United States of America, srpowell@csupomona.edu

As their existing domestic and foreign markets mature and emerging market opportunities dwindle, telecommunications service providers (TSPs) are seeking growth from consolidating their fixed line and mobile platforms to offer integrated data, video, and voice services, often in multiple play bundles. This paper presents a multidimensional technique for analyzing integrated TSPs strategically based on the degree of market attractiveness and competitive strength their business portfolios possess.

2 - Analysis of a Threshold-based Node Sleep Scheduling Policy for Energy Harvesting Sensor Networks

Arupa Mohapatra, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, arupa@tamu.edu, Natarajan Gautam

Autonomous wireless sensor networks with energy harvesting nodes are gaining prominence in long-lived remote surveillance applications. Node sleep scheduling is a popular approach to ensure "energy-neutral" operation in these networks. We present a fluid model based analysis of performance of such a network under a threshold based sleep scheduling policy.

3 - Fast Approximate Choice of Record Length for Large Encrypted Database

David Shallcross, Applied Communication Sciences, Piscataway, NJ, 08854, United States of America, dshallcross@appcomsci.com

To conceal actual record lengths in encrypted databases, we consider choosing a fixed record length. Actual records are to be split and padded to form multiple records of the chosen length. We want to minimize the total memory consumed. An exact optimum can be easily be found in time quadratic in the maximum record length. We now present an approximate algorithm that runs in less time, and also some results on the sensitivity of this approximation to database updates.

4 - Social Capital and Service Continuity: An Investigation of Telecom Service

Hu Hao, Chinese University of Hong Kong, Room 943, 9/F, Cheng Yu Tung Building, Shatin, N.T., Hong Kong, 999077, China, huhao@baf.msmail.cuhk.edu.hk, Jianmin Jia, Yuho Chung

Telecom service forms social network naturally. Consumer's perception of its value depends on social capital in the network. If consumers appreciate the value, they will pay more attention to service continuity and recover soon after abnormal status occurs. Using telecom service data, we examine the role of social capital. The results indicate that network structural properties and reciprocal social norm have significant impact on consumer's attention to service continuity in social network.

■ SC23

23- West 212 C- CC

Edelman 2012 Finalists I

Sponsor: CPMS, The Practice Section

Sponsored Session

Chair: Stephen Graves, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, sgraves@mit.edu

1 - Transformation of HP Business Model through Advanced Analytics and Operations Research

Suresh Subraman, Hewlett-Packard, San Diego, CA, United States of America, Suresh.Subramanian@hp.com

So that Hewlett-Packard customers can shop anywhere anytime, HPDirect.com developed an ECommerce value chain across financial, marketing, warehouse planning and operations departments. Key drivers impacting online traffic were identified and quantified by time series forecasts and regression models. Their holistic customer targeting engine doubled purchase conversion rates and increased order sizes up to 30% -thanks to Bayesian modeling, Markov analysis and Linear Discriminant analysis.

2 - Delivering Profitable Growth for HPDirect.com using Operations Research

Arnab Chakraborty, Director, Global Analytics, HP, No. 66/2, Ward No. 83, Bagmane Tech-Park, Embassy Prime, CV Raman Nagar, Bangalore, Ka, 560093, India, arnab.chakraborty@hp.com, Manav Shroff, Rohit Tandon, Girish Srinivasan

HP's online business, is meant to build robust multi-channel presence given the evolution in shopping behavior. The business benefitted from OR Solutions that overcame problems faced along the e-commerce value chain -Traffic Driver Identification(impacts marketing & budget management),Purchase Pattern Prediction(effective campaign design) AND Order Forecasting(Optimize warehouse inventory holding & order fulfillment).Deploying these solutions since '09 have driven additional revenue of $117Mn.

3 - Centers for Disease Control and Prevention: Advancing Public Health and Medical Preparedness

Greg Burel, Center for Disease Control and Prevention, Washington, DC, United States of America, Greg.Burel@cdc.gov, Eva Lee

CDC public health experts teamed with operations researchers to devise sophisticated modeling and computational strategies to improve mass dispensing. With the powerful information decision-support suite, RealOpt©, expanded capabilities are identified for those with limited resources and stressed environments. Over 4,000 public health and emergency directors can now make rapid and effective interventions for at-risk populations, lessening the subsequent disease mortality and save money.

■ SC24

24- West 213 A- CC

Data Driven Results and Models in Healthcare Operations

Sponsor: Health Applications Society

Sponsored Session

Chair: Hari Balasubramanian, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu

1 - Designing Clinical Trials for Cancer: An Analytics Approach

Stephen Relyea, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, srelyea@mit.edu, John Silberholz, Dimitris Bertsimas, Allison O'Hair

We present a data-driven approach for designing new clinical trials for cancer chemotherapy treatments. Our approach combines (i) text-mining to develop a database of existing trial results, (ii) statistical modeling to predict outcomes of new drug combinations, and (iii) optimization models to select novel treatments that strike a balance between maximizing patient outcomes (exploitation) and learning new things about treatments that may be useful in the future (exploration).

2 - Appointment Reminder Systems and Patient Preferences

Nan Liu, Columbia University, 600 W 168th St., Room 603, New York, NY, 10032, United States of America, nl2320@columbia.edu, Stacey Finkelstein, Beena Jani, David Rosenthal, Lusine Poghosyan

We utilized a cross-sectional design where patients ranked various appointment reminder systems and indicated their usage of technology and familiarity with other service providers contacting them via text message and e-mail. We found that patient usage and familiarity of technology are the best predictors of perceived effectiveness and responsiveness to text message and e-mail reminders. After these variables are accounted for, age and other demographic variables are not significant predictors.

3 - using Emprical Data Analysis and Simulation to Improve Capacity Planning for Inpatient Beds

Asli Ozen, PhD Student, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, aslozen@gmail.com, Hari Balasubramanian

In hospitals nationwide, misaligned bed capacity results in ED crowding and PACU holds. We used patient admission rates, surgery schedules, bed placement rules, length of stays and capacity information from Baystate Medical Center (Springfield, MA) to develop computer based optimization and simulation model to improve capacity allocation of inpatient beds. Our goal is to provide guidelines on how hospitals should manage their inpatient bed capacity in the presence of demand and LOS variability.

4 - Using Empirical Data to Classify Patients for Improved Appointment Scheduling

Hari Balasubramanian, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu, Hyun-Jung Oh, Ana Muriel

We analyze patient flow data for 400 patients collected at a family medicine practice in Massachusetts. We then present an stochastic integer programming model to schedule appointments to minimize a weighted combination of patient waiting and provider idle time. The model sequences patient types with different nurse and physician time requirements and staggers their appointment start times appropriately while keeping the basic slot structure used by the schedulers at the practice.

■ SC25

25- West 213 B- CC

Radiation Therapy Treatment Planning II

Sponsor: Health Applications Society

Sponsored Session

Chair: Edwin Romeijn, Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - Optimizing the Scenario Positions for Robust Radiation Therapy Treatment Planning

Albin Fredriksson, KTH Royal Institute of Technology, Department of mathematics, Royal Institute of Technology, Stockholm, Sw, 100 44, Sweden, albfre@kth.se

Worst case optimization over a set of scenarios is a way to achieve radiation therapy plans that are robust to uncertainties. However, the multiple scenarios exacerbate the conflict between target coverage and healthy tissue sparing, and may lead to unnecessary sacrifices of plan quality even in scenarios with no conflicts. We therefore optimize the scenario positions while enforcing minimum requirements, thereby determining scenario positions where the goals can be simultaneously satisfied.

2 - A Hierarchical Aperture Shape Optimization Method for VMAT Treatment Planning

Chunhua Men, PhD, Elekta, 13723 Riverport Drive, Suite 100, Maryland Heights, MO, 63043, United States of America, chunhua.men@elekta.com, Xiao Han

Volumetric Modulated Arc Therapy (VMAT) is a promising yet complex modern radiotherapy treatment technique. In this talk, we present a hierarchical aperture shape VMAT treatment plan optimization method in which an arbitrary deliverable aperture (e.g., beam-eye-view) is created at each control point, and each aperture is then modified using a two-step approach based on the "price" of each beamlet. Clinical tests show the effectiveness and the efficiency of the proposed method.

3 - Homogeneous Radiation Therapy Treatment Plans for Gamma Knife Perfexion

Kimia Ghobadi, University of Toronto, 5 King's College Road, Tornto, ON, M5S 3G8, Canada, kimia@mie.utoronto.ca, David Jaffray, Mark Ruschin, Dionne Aleman

In this work the feasibility of fractionated radiation therapy (RT) for Gamma Knife Perfexion is studied. In RT, the targets are typically large and overlap with healthy organs, and require homogeneous dose coverage. We use a fast geometry-based algorithm to select isocentres to provide quality RT treatments. After isocentres selection, a sector duration optimization is used to find the final shot shapes. This approach was tested on seven cases and yielded clinically satisfactory treatments.

4 - A Robust Re-optimization Scheme for Intensity Modulated Radiation Therapy (IMRT)

Fei Peng, PhD Candidate, University of Michigan, IOE Department, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, feipeng@umich.edu, Marina Epelman, Edwin Romeijn

Errors in patient setup position can bring uncertainty into radiation therapy treatments. While robust planning before the treatment in some way accounts for this uncertainty, it is unable to foresee variations in the actual delivered dose. We propose a robust re-optimization scheme that adjusts the model according to the delivered dose and the number of fractions remaining, and periodically re-optimizes the plan. Comparison with the one-shot optimization is presented with real-patient cases.

■ SC26

26- North 221 A- CC

Behavioral Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Tava Olsen, Professor, University of Auckland, 12 Grafton Road, Auckland, 1071, New Zealand, t.olsen@auckland.ac.nz

Co-Chair: Valery Pavlov, University of Auckland, 12 Grafton Road, Auckland 1071, New Zealand, v.pavlov@auckland.ac.nz

1 - When Does the Devil Make Work? An Empirical Study of the Impact of Workload on Server's Performance

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Fangyun Tan

We analyze a large, detailed operational data set from a restaurant chain to shed new light on how workload. We find that when the overall workload is low, an increase in the workload leads to higher server performance. However, there is a saturation point after which any further increase in the workload leads to degradation of performance.

2 - Product Launches and Buying Frenzies: A Dynamic Perspective

Javad Nasiry, Assistant Professor, Hong Kong University of Science and Technology, Room 4345, ISOM Dept, HKUST, Clear Water Bay, Kowloon, Hong Kong, Hong Kong-PRC, nasiry@ust.hk, Pascal Courty

Buying frenzies in which a firm intentionally undersupplies a product during its initial launch phase are a common practice within several industries such as electronics. We develop a dynamic model of buying frenzies based on social coordination among customers and characterize the conditions under which they are optimal. We also propose a measure of "consumer desperation" and demonstrate that buying frenzies can have a signifiifcant impact on a firm's profit.

3 - Stuctural Properties of Supply Chain Contracts under Bounded Rationality

Valery Pavlov, University of Auckland, 12 Grafton Road, Auckland 1071, New Zealand, v.pavlov@auckland.ac.nz, Tava Olsen, Elena Katok, Ernan Haruvy

Recent empirical studies on the performance of coordinating contracts made it clear that the standard theory makes strong predictions that are not always fulfilled. Our study aims to characterize structural properties of such popular mechanisms as wholesale pricing, two-part tariffs, and the minimum order quantity contract using the framework of quantal response equilbirium for boundedly rational players.

4 - Newsvendor Decisions when Stakes Matter

Mirko Kremer, Pennsylvania State University, State College, PA, United States of America, muk22@smeal.psu.edu

Research on decision-making in the newsvendor problem has documented systematic order biases and a persistent inability to learn. We argue that these behavioral anomalies persist simply because making many small stakes decisions (the common implementation) allows simple decision heuristics to overpower the motive to make an optimal decision. In a controlled laboratory experiment, we find that subjects in fact learn how to place optimal newsvendor orders when stakes matter.

■ SC27

27- North 221 B- CC

Operations and Logistics Analytics

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@MIT.EDU

1 - Allocating Subsidies as Network Design - Tractable Fairness Constraints for the System Flow Problem

Gonzalo Romero, Massachusetts Institute of Technology, 100 Main Street, E62-461, Cambridge, MA, 02142, United States of America, gromeroy@mit.edu, Retsef Levi, Georgia Perakis

We study the problem faced by a central planner allocating subsidies to competing firms that provide a commodity, to minimize its market price subject to a budget constraint and upper bounds on the allocation to each firm. We consider two types of subsidies, co-payments and technology subsidies, and obtain structural results and near optimal solutions in various important cases. Additionally, we characterize a new kind of tractable fairness constraints for the system optimum flow problem.

2 - Stochastic Optimization for Resource Allocation with Random Emergencies
Joline Uichanco, Massachusetts Institute of Technology, Cambridge, MA, United States of America, uichanco@mit.edu, Mallik Angalakudati, Siddharth Balwani, Jorge Calzada, Georgia Perakis, Nicolas Raad

We study the problem of scheduling jobs to resources, assuming a random number of emergency jobs arrive in the future. We model the problem using stochastic optimization. We propose decomposition techniques and heuristics, for which we prove analytic performance guarantees. We apply these to a major US gas utility company to schedule its services. Using actual data, we show that our model reduces overtime by 65%. The company is currently piloting a web-based planning tool using our models.

3 - Maintenance and Flight Scheduling of Low Observable Aircrafts
Retsef Levi, Massachusetts Institute of Technology, 100 Main Street, Building E62-562, Cambridge, MA, United States of America, retsef@mit.edu, Vivek Farias, John Kessler, Thomas Magnanti, Yaron Shaposhnik, Yaron Zarybnisky

We study maintenance scheduling issues that are unique to the Air Force's low-observable aircraft. We classify this problem as a modified restless multi-armed bandit problem, which allows for multiple types of actions (different maintenance actions). Using an LP relaxation, we are able to develop index policies that allow us to decide the timing and type of maintenance to perform on which aircraft, as well as select which planes should be flown for operations each day.

4 - Integrated Sales and Operations Strategies for Differentiated Fresh Products
Zhengliang Xue, IBM Research, 1101 Kitchawan Rd., Route 134, Yorktown, NY, 10598, United States of America, zxue@us.ibm.com, Markus Ettl, David Yao

We study the coordination of pricing and inventory strategies contingent on product freshness. A retailer sells both fresh and frozen products where the fresher provides a higher quality but perishes quickly. Customers are segmented as high-end and low-end, and high-end customers are more sensitive to freshness. Customers might upgrade or downgrade their purchase if a stock-out takes place. We analyze the joint pricing and inventory decisions to maximize the expect profit under uncertain demand.

■ SC28

28- North 221 C- CC

Empirical Research in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Vishal Gaur, Professor, Cornell University, Johnson School, Ithaca, NY, 14853, United States of America, vg77@cornell.edu

1 - Deriving Supply Chain Metrics from Financial Statements
Robert Bray, Assistant Professor, Kellogg/Northwestern, 311 Sheridan Ave., Palo Alto, CA, 94306, United States of America, robertlbray@gmail.com, Haim Mendelson

We develop an empirical supply chain model that enables empiricists to derive operational metrics from "demand signal processing" how demand information flows through supply chains and perform corresponding counterfactuals. The metrics illuminate previously-obscure supply chain aspects, and the counterfactuals permit related "what if" studies. We demonstrate our methodology with six studies and firm-level Compustat data.

2 - Managing Global Sourcing: Inventory Performance
Karan Girotra, INSEAD, Boulevard de Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Nitish Jain, Serguei Netessine

The shift towards sourcing products from global suppliers has been a key economic trend over the last three decades. This study provides the first rigorous firm-level empirical evidence, using over half a million sea shipments from global suppliers to US firms, on the operational impacts of global sourcing and provides actionable guidance for managing global sourcing.

3 - When Disruptions Matter: An Exploration of Disruption Types and Moderators
William Schmidt, Harvard Business School, Wyss House, Boston, MA, 02163, United States of America, wschmidt@hbs.edu, Ananth Raman

We research and identify several factors that drive a differential impact of supply chain disruptions on company value. Our research reveals that the market distinguishes between disruptions not only based on the characteristics of the disruption, but also on the characteristics of the company which are under management's direct control. Insight on this issue can help managers structure their operations and target risk mitigation efforts toward those disruptions that destroy the most value.

4 - Does Inventory Turnover Predict Future Stock Returns?
Yasin Alan, Cornell University, Sage Hall, Room 301R, Ithaca, NY, 14850, United States of America, ya47@cornell.edu, Vishal Gaur, George Gao

We examine the impact of inventory turnover performance of publicly listed U.S. retailers on their stock returns using the traditional approach in the asset pricing literature with annual test portfolios. We find that high inventory productivity is a strong predictor of future stock returns, and investigate potential reasons.

■ SC29

29- North 222 A- CC

Queueing Control

Cluster: Workforce Management

Invited Session

Chair: Eser Kirkizlar, State University of New York - Binghamton, School of Management, Binghamton, NY, United States of America, eser@binghamton.edu

1 - Optimal Admission Control Policies for Two Station Tandem Queues with Loss
Daniel Silva, Georgia Institute of Technology, Atlanta, GA, 30363, United States of America, dfsi3@gatech.edu, Hayriye Ayhan, Bo Zhang

We study a system of 2 queues in tandem, the 1st station has a buffer of size one, the 2nd has an arbitrary buffer. There is a gatekeeper and losses incur when a job is turned away at the first station or when the second is full upon service completion at the first. We fully characterize the optimal policy to minimize long run average cost for systems with small to moderate buffers at the 2nd station. We also propose an easily implementable heuristic policy that yields near optimal performance.

2 - Dynamic Control of a Closed Two-stage Queueing Network for Ship Production with Outfitting
Fang Dong, University of Michigan, Ann Arbor, MI, United States of America, ppfang@umich.edu, Mark Van Oyen, Soroush Saghafian, David Singer

As an essential and complex part of ship construction, outfitting represents at least 50% of ship construction cost and time. Ship block outfitting is most cheaply done at the steel block fabrication (stage 1), but at increased cost and time, it can be done at the final ship assembly (stage 2). We develop a closed two-stage queueing network MDP model with decisions as to where outfitting is performed to gain insights into optimal scheduling control policies.

3 - Parametric Analysis of Optimal Admission Policies in Tandem Queueing Networks
William Millhiser, Assistant Professor, Baruch College, City University of New York, One Bernard Baruch Way, Box B9-240, New York, NY, 10010, United States of America, william.millhiser@baruch.cuny.edu

We derive the parametric analysis of optimal admission policies in tandem queues with or without blocking after service. Our method is event-based dynamic programming. Such analysis allows insights into how admission policies are sensitive to price, demand, service rates, and workforce staffing choices; it is generally applicable to systems where service is delivered in stages and advance reservations are not taken. We give a counterintuitive result, an open problem, and a conjecture.

4 - Skill and Capacity Management in Large-scale Marketplaces
Eren Cil, University of Oregon, 1208 University of Oregon, Eugene, OR, 97403-1208, United States of America, erencil@uoregon.edu, Gad Allon, Achal Bassamboo

We characterize the optimal skill screening mechanism of a firm moderating a large-scale service marketplace where the ability of a service provider to cater customers, who can be of two classes, varies. We show that when the values that a service provider generates for each customer class are independent, the firm may need to refuse some of the service providers via its screening mechanism whereas this is never optimal when these values are perfectly correlated.

■ SC30

30- North 222 B- CC

Risk Mitigation in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/IFORM

Sponsored Session

Chair: Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Ave., Syracuse, NY, 13244, United States of America, bkazaz@syr.edu

1 - Quick Response Rules for Updating Inventories of Substitutable Products with Short-Term Forecast Updating

Saurabh Bansal, Assistant Professor, Pennsylvania State University, 405 Business Building, University Park, PA, United States of America, sub32@psu.edu, James Dyer

This paper presents results for determining optimal inventory levels for a newsvendor who (i) makes a joint-inventory decision for multiple substitutable products for the next replenishment period using latest forecasts, and (ii) knows the forecasts and the corresponding optimal inventory levels for the current replenishment period. These results are extremely easy to implement when faced with sudden demand shocks.

2 - Corn or Soybean: Optimal Farm Space Allocation under Yield and Price

Cerag Pince, cerag.pince@the-klu.org, Onur Boyabatli, Javad Nasiry

We consider farm space allocation decision between corn and soybean in a multi-period setting. In each period the farmer decides the allocation due to yield and spot price uncertainties given the cross-farming benefit, i.e, the yield is stochastically larger when a product is not grown in the same farm space for two consecutive periods. We investigate the impact of yield and price variability for each product, and the correlation among these uncertainties on the optimal farm allocation decision.

3 - Wine Futures and Advance Selling under Quality Uncertainty

Tim Noparumpa, Assistant Professor, Providence College, Providence College School of Business, Koffler Hall, Providence, RI, United States of America, tnoparum@syr.edu, Burak Kazaz, Scott Webster

We examine the use of wine futures as a form of operational flexibility to mitigate quality-rating risk in wine production. As the wine ages in barrels, the firm has to determine what proportion of its wine should be sold as futures, and what proportion should be sold in retail. While advance selling enables the firm to recuperate the investment early and pass on the risk of holding inventory that is uncertain in value to consumers, it can also lead to smaller returns than retail revenues.

4 - Agricultural Supply Chain Planning under Yield Uncertainty

Nur Cavdaroglu, Post-doctoral Researcher, Whitman School of Management Syracuse University, Whitman School of Management Syracuse Un, Syracuse, NY, 13244, United States of America, ncavdaro@syr.edu, Burak Kazaz, Scott Webster

We consider the production planning problem in an agricultural supply chain with a single retailer and multiple farmers. The quality level of the product is directly proportional with the improvement effort (e.g. fertilization) during the cultivation phase and the price of the end-product changes accordingly with farmers' efforts. We analyze the problem and develop pricing mechanisms that coordinate the system and induce farmers' to invest in the same level of effort with the centralized system.

■ SC31

31- North 222 C- CC

Models of Risk and Uncertainty in Supply Chains

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Ed Pohl, University of Arkansas, Department of Industrial Engineering, Fayetteville, AR, United States of America, epohl@uark.edu

1 - A Cargo Prioritization Model for Inland Waterway Disruptions

Jingjing Tong, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, United States of America, tong@uark.edu, Heather Nachtmann

For an ongoing project funded by the U.S. Department of Homeland Security, we are developing a cargo prioritization model that can provide timely knowledge regarding what barges should be prioritized for offloading when the inland waterway is closed or reduced due to a disruption. Our presentation focus is the formulation of a non-linear binary integer cargo prioritization model that considers terminal capacity, barge draft, cargo value, and commodity type.

2 - Impact of Random Yield in Decentralized Supply Chains with Competing Suppliers

Fei Qin, PhD Candidate, University of Cincinnati, College of Business, 312 Carl H. Lindner Hall, Cincinnati, OH, 45221, United States of America, qinfi@mail.uc.edu, Haresh Gurnani, Uday Rao

We investigate supply chain (SC) performance when suppliers have unreliable service rate, defined as a random proportion of the planned production quantity. We look at single sourcing as well as dual sourcing, where both suppliers compete. We check the SC agents' optimal solutions when the suppliers differ from one another in terms of their yield distributions, their procurement costs, and their risk correlation levels.

3 - Securing Global Medical Nuclear Supply Chains through Economic Cost Recovery and Risk Management

Dong Li, Univerity of Massachusetts-Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, dongl@som.umass.edu, Anna Nagurney, Ladimer Nagurney

In this paper, we develop a new generalized network model for the optimization of the complex operations of medical nuclear supply chains in the case of the radioisotope molybdenum, with a focus on minimizing the total operational cost, the total waste cost, and the risk associated with this highly time-sensitive and perishable, but critical, product used in healthcare diagnostics. A case study for North America demonstrates how our model and computational framework can be applied in practice.

■ SC32

32- North 223- CC

Assembly Line Design and Balancing II

Contributed Session

Chair: Jeonghan Ko, Ajou University and University of Michigan, Department of Industrial Engineering, Suwon, Korea, Republic of, jko@ajou.ac.kr

1 - Energy Considerations in a Two Machine Flowshop Scheduling Problem with Sequence Dependent Setups

Afshin Mansouri, Senior Lecturer in Operations and Supply Chain Management, Brunel Business School, Brunel University London, Uxbridge, UB8 3PH, United Kingdom, Afshin.Mansouri@brunel.ac.uk, Emel Aktas

A two-machine flowshop permutation scheduling problem is addressed to minimize Cmax and energy consumption as conflicting criteria. We develop a mathematical formulation and propose a Multi-Objective Genetic Algorithm (MOGA) to find approximations of the Pareto front. Performance of the MOGA is compared with Cplex on various problems. The MOGA can support informed decision making via trade-off analysis between Cmax as a measure of service and energy consumption as a measure of sustainability.

2 - Mathematical and Heuristic Approaches for Simultaneous Balancing and Sequencing Problem

Rifat Gurcan Ozdemir, Istanbul Kultur University, Atakoy Campus D100 Yanyol, Istanbul, Turkey, rg.ozdemir@iku.edu.tr, Selin Kapcak, Tugce Hanci

Mixed model assembly line balancing and sequencing problems are solved simultaneously by using a mathematical model and a heuristic algorithm. In balancing problem, tasks are assigned to the stations for minimizing unbalanced workload. In sequencing problem, launching sequence of products is determined for minimizing total amount of uncompleted work. A case problem is solved for illustrating the performances of the developed mathematical model and the heuristic algorithm.

3 - Exploring the Efficient Frontier of the Multi-objective General Assembly Line Balancing Problem

Bryan Pearce, Clemson University, Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, United States of America, bpearce@clemson.edu, Kavit Antani, Kilian Funk, Mary E. Kurz, Maria Mayorga, Laine Mears, Alireza Madadi

Methods for the general assembly line balancing problem are presented for environments with mixed-model flow, multi-manned stations, and a variety of task assignment constraints. Several figures of merit can be considered, with metaheuristic and heuristic methods to support exploring alternative solutions.

4 - Lot-streaming in Assembly Shops
Niloy Mukherjee, PhD Candidate, Virginia Polytechnic and State University, 114 Durham Hall, Blacksburg, VA, 24060, United States of America, niloym@vt.edu, Subhash C. Sarin

We address a two-stage, multiple-lot assembly shop, lot streaming problem. While lot streaming reduces the makespan, it also increases handling costs. Given a sequence in which to process the lots, we develop a polynomial time algorithm to obtain optimal sublot sizes that minimize a weighted sum of the makespan and transportation costs. A method for sequencing the lots is also proposed.

5 - Assembly Decomposition for Supply Chain and Subassembly Planning Considering Component Quality
Jeonghan Ko, Ajou University and University of Michigan, Department of Industrial Engineering, Suwon, Korea, Republic of, jko@ajou.ac.kr, Hui Wang

We present a decomposition model to divide the assembly to subassemblies to be joined in the final assembly process. This new graph-theoretic approach evaluates the effect of subassembly and supply chain structures on the final product quality. The evaluation also considers the defect rates of components and assembly tasks as well as inspection errors. The results suggest that the defect rate of the final product can be managed better by proper subassembly planning and supplier selection.

■ SC33

33- North 224 A- CC

Sustainable Operations and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations

Sponsored Session

Chair: Tim Kraft, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States of America, kraftt@darden.virginia.edu

1 - Environmental and Economic Assessment of Remanufacturing Strategies for Product+Service Firms
Anton Ovchinnikov, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, Ovchinnikova@darden.virginia.edu, Gal Raz, Vered Blass

This paper provides a data-driven assessment of economic and environmental aspects of remanufacturing for product+service firms. We present a model, conduct a behavioral experiment to estimate consumer demand, and based on the realistic parameter values obtained from an industrial partner examine when and why remanufacturing results in higher profit and lower environmental damage.

2 - Making use of Dual Sourcing to Reduce Carbon Emissions in Transport
Tarkan Tan, Eindhoven University of Technology, Den Dolech 2, Pav F-7, Eindhoven, 5612AZ, Netherlands, T.Tan@tue.nl, Kristel Hoen, Geert-Jan van Houtum, Jan Fransoo

We consider a carbon-aware company that orders several products from suppliers, which can be fulfilled via a fast or a slow channel. We study a multi-item dual-sourcing problem subject to an emission constraint. We use a single-index order policy that specifies two order-up-to levels and we find solutions for the multi-item setting that meet the emission constraint. Making use of actual emission figures, we elaborate on factors that determine when significant emission reductions can be achieved.

3 - To Sell and to Provide? The Implications of the Auto Manufacturer's Involvement in Car Sharing
Yannis Bellos, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, United States of America, Ioannis.Bellos@mgt.gatech.edu, Beril Toktay, Mark Ferguson

We study the auto manufacturer's choice regarding whether to provide mobility service (e.g., car sharing) in conjunction with the traditional sales channel. We explicitly model the consumer's choice between purchasing a vehicle, benefiting from the mobility service or relying on an outside option (e.g., public transportation) as well as the vehicle usage decisions. We characterize the benefit to the manufacturer of providing mobility service and the environmental implications of this strategy.

4 - The NGO's Dilemma: How to Influence Firms to Replace a Potentially Hazardous Substance
Tim Kraft, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States of America, kraftt@darden.virginia.edu, Yanchong Karen Zheng, Feryal Erhun

In this paper, we analyze an NGO's decisions when a substance within a product is identified as potentially hazardous (e.g., BPA). We determine under what market and regulatory conditions an NGO should target the industry versus a regulatory body in order to influence firms to replace a substance. We consider the perspectives of both an antagonistic NGO that maintains an arms-length relationship with firms and a pragmatic NGO that takes into consideration firm costs when making its decisions.

■ SC34

34- North 224 B - CC

Collaboration and Innovation in Product Development

Contributed Session

Chair: Celestine Aguwa, Visiting Assistant Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, celestine.aguwa@wayne.edu

1 - Effect of Bargaining Power and Information Asymmetry on Product Quality in Outsourcing
Narendra Singh, PhD Candidate, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, Narendra.Singh@mgt.gatech.edu, Stylianos Kavadias, Ravi Subramanian

We examine the effect of outsourcing on product quality when the OEM has a backup option of manufacturing the product herself. We characterize the situation as a game-theoretic model consisting of sequential decisions made by the OEM and the contract manufacturer (CM) in two scenarios - the CM offering the contract to the OEM, and vice-versa. We contrast the results for the two scenarios in the absence and presence of information asymmetry about cost structure.

2 - Choice of Equity Partnerships for New Product Development
Niyazi Taneri, Singapore University of Technology and Design, 20 Dover Drive, Singapore, Singapore, niyazitaneri@sutd.edu.sg, Arnoud De Meyer

We develop two games of equity partnerships for Joint Ventures and Licensing Agreements. We find that operational constraints have opposing impacts on the value from each partnership structure and play a role in the choice among the two alternatives. Analysis of alliance choice data from the pharmaceutical industry supports our analytical results.

3 - Effect of Correlated Beliefs on the Survival of Collaborative R&D Projects
Xiang He, University of Cambridge, Emmanuel College, Saint Andrews Street, Cambridge, CB2 3AP, United Kingdom, xh232@cam.ac.uk, Nektarios Oraiopoulos

Owing to the remarkable uncertainty in drug R&D, biotech and pharmaceutical firms often engage in exploratory R&D within multiple alliances. Case evidence suggests that contracts are often writ with neither party having an accurate estimate of the value of the drug candidate. Accordingly, we study the effectiveness of R&D collaboration on the project level when both firms have imperfect but correlated beliefs about the quality of the drug candidate.

4 - The Impact of Exploration and Exploitation on Innovation Success and Innovation Failure
Jennifer Bailey, Georgia Institute of Technology, 800 W. Peachtree Road, NW, Atlanta, GA, United States of America, Jennifer.Bailey@mgt.gatech.edu, Manpreet Hora

We investigate the impact of exploration and exploitation learning activities on the innovation process. Specifically, our two-pronged approach examines how these activities can be effectively harnessed to first, achieve innovation success and second, to mitigate innovation failure. We utilize patent data in the biotech industry to test our hypotheses.

5 - Effect of Ratings Modification on a Fuzzy-based Modular Architecture for Medical Device Design
Celestine Aguwa, Visiting Assistant Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, celestine.aguwa@wayne.edu, Leslie Monplaisir, Prasanth Sylajakumari

This research is to determine the effect of customer ratings on the optimal number of modules for medical device design. To address this issue, a typical glucometer is used as proof of concept to demonstrate the methodology and analyze the impact of changing the customer ratings on the optimal number of modules and minimum deviation. The implication is to generate scholarly work and to reduce the number of potential failure points in medical devices by determining the optimal number of modules.

■ SC35

35- North 225 A- CC

Ticket Pricing and Demand Estimation

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Ozge Sahin, Johns Hopkins University, 100 International Dr., Baltimore, MD, 21202, United States of America, ozge.sahin@jhu.edu

1 - Should Event Organizers Prevent Resale of Tickets?
Yao Cui, PhD Candidate, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, cuiyao@umich.edu, Izak Duenyas, Ozge Sahin

We are interested in whether preventing consumer resale of tickets benefits capacity providers for sporting and entertainment events. Consumers' purchasing decisions take into account their inter-temporal valuations as well as their potential opportunity to resell the tickets. We compare the revenues from fixed pricing, dynamic pricing and pricing with options, and consider how the capacity provider's revenues change with respect to the transaction cost of resale under each pricing strategy.

2 - Semi-parametric Estimation of Ticket Purchases at a Theater
Necati Tereyagoglu, Assistant Professor, Georgia Institute of Technology, College of Management, Atlanta, GA, United States of America, necati.tereyagoglu@scheller.gatech.edu, Senthil Veeraraghavan

We develop a semi-parametric competing proportional hazard framework that models the dynamic effects of an organization's show and time related pricing decisions on the customer's propensity to purchase a ticket for a variety of shows during a specified timeframe. We test our model on ticket sales and seat pricing data for a season of 21 concerts from a leading performing arts organization. We suggest a discounting policy using these estimates.

3 - Revenue Management of Consumer Options for Tournaments
Caner Gocmen, Columbia Business School, 3022 Broadway, Uris Hall, 4V, New York, NY, 10027, United States of America, fgocmen13@gsb.columbia.edu, Robert Phillips, Guillermo Gallego, Santiago Balseiro

We analyze tournament options where the event manager sells team-specific options for a tournament final, such as the Super Bowl, before the finalists are determined. These options guarantee a final game ticket to the bearer if her team advances to the finals. We develop an approach by which an event manager can determine the revenue maximizing prices and amounts of tickets and options to sell for a tournament final. We show that offering options can increase expected revenue and social welfare.

4 - Endogeneity and Price Sensitivity in Customized Pricing
A. Serdar Simsek, PhD Candidate, Columbia Business School, 3022 Broadway, Uris Hall, 4L, New York, NY, 10027, United States of America, asimsek13@gsb.columbia.edu, Robert Phillips, Garrett Van Ryzin

Endogeneity occurs in customized pricing when a seller uses unrecorded customer characteristics correlated with price-sensitivity in setting the price. Endogeneity can lead traditional regression approaches to under-estimate price elasticity. We use two sources of data from auto loan pricing: one from an on-line lender and one from an indirect lender to test for endogeneity. We present our results as well as recommendations for how to detect and control for endogeneity in the estimation process.

■ SC36

36- North 225 B- CC

Revenue Management and Pricing Applications

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Ahmet Kuyumcu, President, Prorize LLC, 3399 Peachtree Rd NE, STE 400, Atlanta, GA, 30326, United States of America, akuyumcu@prorize.com

1 - Revenue Optimization for Rental Industry
Hossam Zaki, Vice President, Zilliant, Austin, TX, United States of America, hossam.zaki@zilliant.com

This presentation will provide insights and comparisons between the revenue management (RM) problem for the One-Way Truck Rental industry and other traditional RM problems (e.g. equipment rental, car rental, airline and air cargo). We will also describe the main components of a typical RM system and several design and deployment options.

2 - Optimal Pricing for Student Housing
Jian Wang, Vice President, The Rainmaker Group, 4550 North Point Parkway, Suite 400, Alpharetta, GA, 30022, United States of America, jwang@letitrain.com

The application of revenue management to conventional multi-family housing has been successful, but it is new to student housing. In this presentation, we describe some unique characteristics of student housing, and point out the drawbacks of prevalent pricing methods. We then propose an optimal pricing model, and illustrate the application to a real case.

3 - Luxury Yacht Rentals – How to Forecast Demand and Optimize Prices?
Pelin Pekgun, Assistant Professor, University of South Carolina, Moore School of Business, 1705 College Street, Columbia, SC, 29208, United States of America, Pelin.Pekgun@moore.sc.edu, Ronald Menich

Luxury yacht rentals is a niche market with a unique business model that presents rich revenue opportunities but also makes it vulnerable in a challenging economy. Traditional forecasting approaches do not work due to data sparsity and low volume of transactions, while pricing becomes difficult with hard-to-identify price elasticity from customers that already pay high prices. We present a forecasting and optimization framework that can address the unique challenges in this environment.

4 - Market Share Modeling in Revenue Management
Ahmet Kuyumcu, President, Prorize LLC, 3399 Peachtree Rd. NE, Ste. 400, Atlanta, GA, 30326, United States of America, akuyumcu@prorize.com, Utku Yildirim

Market share modeling could be effectively used when demand and price data for majority of the competing products is available. This presentation briefly reviews market share modeling and provides successful real-world applications.

■ SC37

37- North 226 A- CC

Location Models

Sponsor: Location Analysis

Sponsored Session

Chair: Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - Linearization Techniques for the p-Median Problem with Unreliable Facilities
Serigne Gueye, Assistant Professor, University of Avignon, 339 chemin des Meinajariès, Agroparc BP 91228, Avignon, 84911, France, sgueye@zlc.edu.es, Mozart Menezes

The p-Median problem with unreliable facilities consists in locating m unreliable facilities to n customers in such a way to minimize the expected cost of serving the customers. Each facility has a disruption probability, independent to the site location and to other facility. The problem is expressed as a bilinear program for which some linearization techniques are applied. Numerical tests are then performed.

2 - The Downside Risk-averse Center on a Network
Jiamin Wang, Long Island University, Long Island, NY, United States of America, Jiamin.Wang@liu.edu

We consider finding a location that minimizes the maximum expected weighted distance to the nodes of a network with random demand weights. This problem is similar to the classical center problem except VAR, a downside risk-averse measure, is adopted as a constraint. We derive a set of dominant points and develop algorithms for demand weights of discrete and continuous probability distributions. This study provides a better understanding of the impact of risk attitude on location decisions.

3 - Minimax Regret Covering Location on a Network under Uncertainty
Oleksandr Shlakhter, University of Toronto, Joseph L. Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, alex.shlakhter@Rotman.Utoronto.Ca, Dmitry Krass, Oded Berman

We consider p-cover problem on a network with uncertain weights of nodes. For each node only interval estimate of its weight is known. The problem is to find the "minimax regret" covering location, i.e. to minimize worst case loss in objective function because a location decision is made without knowing the actual weights at nodes. We present the algorithm for this problem on a general network. We also consider two special cases, when the solution algorithm is polynomial.

4 - Resource Allocation for a New Product Introduction: Joint Facility Location and Marketing Strategies

Vahideh Sadat Abedi, PhD Candidate, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, VahidehSadat.Abedi07@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

We analyze the problem of joint design of the network of retail facilities and marketing strategies of a firm introducing an innovative product or service to a network of markets. After introducing a framework for the joint study of these decisions, we study the effect of different types of marketing media and their substitutive behaviour. We also investigate allocation of resources of the firm between different types of media and opening facilities.

■ SC38

38- North 226 B- CC

Service Operations and Retailing

Sponsor: Service Science

Sponsored Session

Chair: Olga Perdikaki, Assistant Professor, Mays Business School at Texas A&M University, 320 Wehner Building, College Station, TX, 77843-4217, United States of America, operdikaki@mays.tamu.edu

1 - Timining of Service Investments under Competition and Demand Uncertainty

Olga Perdikaki, Assistant Professor, Mays Business School at Texas A&M University, 320 Wehner Building, College Station, TX, 77843-4217, United States of America, operdikaki@mays.tamu.edu, Jayashankar M. Swaminathan, Dimitris Kostamis

We study how competition and demand uncertainty affect firms' timing of service level decisions relative to demand realization. We model a symmetric duopoly in which firms compete on price and service levels and analytically characterize the Nash equilibrium in the timing of service level decisions.

2 - Retail Execution and Store Associate Incentive Design

Nicole DeHoratius, Zaragoza Logistics Center, Edifico Náyade 5, C/ Bari 55-Plaza, Zaragoza, Spain, NDeHoratius@zlc.edu.es, Saravanan Kesavan, Adam Mersereau

We determine the extent to which a change in the design of store associate incentives at several pilot stores of a major retail chain drive store associate effort allocation and consequently store performance. Our results yield insights useful to a retail chain seeking to maximize long-term profitability rather than short-term sales when designing store associate incentive plans.

3 - Inventory Record Inaccuracy: Operational Causes and Labor Effects

Howard Hao-Chun Chuang, PhD Candidate, Mays Business School at Texas A&M University, College Station, TX, 77843-4217, United States of America, hchuang@mays.tamu.edu, Rogelio Oliva

Inventory record inaccuracy (IRI) can be attributed to shrinkage, misplacement, and transaction errors. We develop a system dynamics model that captures the physics of in-store operations while integrating multiple sources of error. By performing Monte-Carlo simulation, we confirm the conjecture that labor-related errors are roor causes of IRI. We then empirically test the impact of store labor and environments on IRI using Bayesian shrinkage estimation and panel data modeling.

4 - Optimal Dynamic Return Management of Fixed Inventories

Mehmet Sekip Altug, Assistant Professor, George Washington University, 2201 G. Street, NW, Washington, DC, United States of America, maltug@gwu.edu

We consider a retailer that sells a fixed amount of inventory over a finite horizon. We assume that return policy is a decision variable which can be changed dynamically at every period. While flexible return policies generate more demand, it also induces more returns. We characterize the optimal dynamic return policies based on two costs of return scenarios. We find out how these policies change with inventory and time. We extend our model to multiple competing retailers.

■ SC39

39- North 226 C- CC

Service Science & Innovations with Analytics

Sponsor: Service Science

Sponsored Session

Chair: Haluk Demirkan, Professor, Arizona State University, P.O. Box 874606, Tempe, AZ, 85287, United States of America, haluk.demirkan@asu.edu

1 - Transitioning to a Service-oriented Business Model: A Technology Roadmapping Approach

Robert Harmon, Professor of Marketing & Technology Management, Portland State University, School of Business, Portland, OR, 97207, United States of America, corevalue@comcast.net, Bill Hefley, Haluk Demirkan

For technology firms, the evolution from manufacturing to service-dominant business models as a primary driver of innovation has become an important trend. This research reviews the literature on the key dimensions, frameworks, and organizational considerations for the service transition process. It utilizes a technology roadmapping approach to illustrate the issues and strategy dimensions faced by a technology manufacturer as it navigates the service transition process.

2 - Quality of Service Modeling for Internet Service Providers

Seyedreza Mousavi, Arizona State University, BA 319, WPC School of Business, Arizona State University, Tempe, AZ, 85287, United States of America, smousav4@exchange.asu.edu

According to the literature, there are three main contributors to quality of service of internet service providers: traffic and network engineering, network architecture, and interconnection. The current study attempts to develop a model in which market and quality factors are linked together. A panel of experts rated the strength of each relationship in the model. The results revealed how the contributors to the QoS significantly impact the ISP's profit.

3 - Effects of Electronic Payment Services on Consumer Behavior in Electronic Retailing: A Research Prop

Irfan Kanat, Arizona State University, W.P. Carey School of Business, Tempe AZ 85287, United State of America ikanat@asu.edu, Ajay Vinze, Paul Steinbart

e-payment services advanced rapidly in the recent years. Major e-retailers like e-bay are now players in the market, traditional financial institutions are trying to defend their positions with new products. Each service offers a different set of features suited for different transactions. The effects of the features sets on consumer behavior has not been investigated in the literature. We present a review of the literature and propose a quasi experimental research design to address this gap.

■ SC40

40- North 227 A- CC

Wind Energy, Optimal Location and Effective Utilization

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Golbon Zakeri, University of Auckland, 70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz

1 - Mitigating Real Time Price Uncertainty Induced by Wind Power through Stochastic Unit Commitment

Anthony Papavasiliou, University of California at Berkeley, 4141 Etcheverry Hall, IEOR Department, Berkeley, CA, 94720-1777, United States of America, anthony.papavasiliou@gmail.com, Yi He, Alva Svoboda

Wind power supply uncertainty introduces significant uncertainties in day-ahead trading due to its impact on real-time electricity prices. In particular, in the day ahead market utilities face the challenge of self-commitment, self-scheduling and cycling decisions on slow units. We present a stochastic unit commitment model and solution methodology for addressing these challenges and demonstrate savings relative to current practice which is based on deterministic models.

2 - The Effects of Stochastic Market Clearing on the Cost of Wind Integration: A Case of New Zealand Electricity Market

Javad Khazaei, Princeton University, Department of ORFE, Princeton, NJ, United States of America, jkhazaei@princeton.edu, Geoff Pritchard, Golbon Zakeri

Implementing a stochastic electricity market clearing, as a suggested alternative to conventional clearing mechanisms, can impose some extra cost on the market. Therefore, it is essential to estimate the efficiency gain resulting from implementing a stochastic market clearing mechanism. We describe the result of an empirical study to quantify value of a stochastic clearing mechanism for the New Zealand electricity market. We extend our analysis for possible larger wind integration in the future.

3 - Modeling the Economics of Variable Generation Resources

James Merrick, Electric Power Research Institute (EPRI), 3420 Hillview Avenue, Palo Alto, CA, 94304, United States of America, jmerrick@epri.com, Geoffrey Blanford

The US-REGEN model is a general equilibrium model of the United States economy, with a detailed regional representation of the power sector. The power sector component is formulated as a quadratic programming problem. This talk will provide an overview of the optimization formulation, focusing on how the spatial and temporal distributions of variable generation resources are represented. The formulation of the sub-problem to choose and weight representative hours will be additionally presented.

4 - Capacity Expansion in an Electrical System with Intermittent and Weather-dependent Generation

Phil Bishop, Senior Economist, Electricity Authority, P.O. Box 10041, Wellington, 6143, New Zealand, phil.bishop@ea.govt.nz, Bruce Smith

The electricity system in NZ is dominated by generating plant based on highly variable hydrological resources yet conditions currently favor investment in geothermal and intermittent plant. Capacity expansion in this setting entails challenges for the efficient and reliable operation of the system and imposes costs beyond those incurred by the generation investor. A capacity expansion model with a detailed treatment of firming requirements is described and simulation results are presented.

■ SC41

41- North 227 B- CC

Renewable Energy Issues

Contributed Session

Chair: Paulo Correia, Professor, Unicamp, Energy Department, Campinas, Brazil, pcorreia@fem.unicamp.br

1 - Costs and Environmental Attributes of Bulk Energy Transportation Options for Renewable Energy

Elisabeth Gilmore, University of Maryland, 2101 Van Munching Hall, College Park, MD, United States of America, gilmore@umd.edu, Andrew Blohm

We develop a multi-attribute decision model to evaluate options for long distance transport of bulk energy from renewable sources, focusing on the cost and environmental trade-offs. We find that the preferred option depends on distance, the amount of energy to be transported, and the existing infrastructure and markets. We apply the model to an ocean thermal energy conversion (OTEC) installation where we include moving the energy as ammonia, either as an energy carrier or as fertilizer.

2 - Competition, Welfare and Green Energy

Talat Genc, University of Guelph, Department of Econ, Guelph, N1G2W1, Canada, tgenc@uoguelph.ca

We estimate the behavior in hourly wholesale electricity auctions and address some policy questions relevant to intermittent technologies and air pollution in a dynamic game-theoretic analysis. We examine the Ontario wholesale electricity market and find that our competition model has a high predictive power. MAE for our price estimations is much lower than the one for ISO estimations. We also calculate the welfare loss generated in the market.

3 - Wind Farm Layout Optimization Considering Multiple Objectives

Jose Espiritu, Assistant Professor, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, jfespiritu@utep.edu, Carlos Ituarte-Villarreal, Nicolas Lopez, Heidi Taboada

This work presents a new multiple objective evolutionary algorithm to obtain optimal placement of wind turbines in a wind farm, the objective functions considered are the maximization of power output, the minimization of wind farm cost and the maximization of system reliability. In the present work, we solve three well known problems. The final solution to this multiple objective problem is presented as a set of Pareto solutions.

4 - Studying Various Optimal Control Problems in Biodiesel Production in a Batch Reactor under Uncertainty

Pahola Benavides, Graduate Student, University of Ilinois at Chicago, Industrial Engineering, Chicago, IL, 60607, United States of America, ptatibg@uic.edu, Urmila Diwekar

Optimal control problems encountered in biodiesel production are formulated using various performance indices like maximum concentration, minimum time, and maximum profit. The problems involve determining optimal temperature profile so as to maximize these performance indices. This paper presents these three formulations with and without variability and uncertainty in feed composition.

5 - Trading Energy from Wind Plants with a Portfolio Approach

Paulo Correia, Professor, Unicamp, Energy Department, Campinas, Brazil, pcorreia@fem.unicamp.br, Laura Gunn

The growing environmental impacts associated to the generation of electric energy highlights the need to expand the use of renewable energy sources. These sources use natural resources whose availability depends on climate behavior which normally entails a certain intrinsic risk. Therefore, the evaluation of an alternative energy source project always involves a commitment between the expected benefit and the risk incurred, which can be conveniently dealt with a Markovitz benefit-risk model.

■ SC42

42- North 227 C- CC

Routing and Travel Time Prediction

Contributed Session

Chair: Behzad Aghdashi, Research Assistant, North Carolina State University, 2510-203 Avent Ferry Rd, Raleigh, NC, United States of America, saghdas@ncsu.edu

1 - Improved Tour Determination for the Dynamic Traveling Salesman Problem

Taesu Cheong, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, 117576, Singapore, isects@nus.edu.sg, Alan Erera, Chelsea (Chip) White

After each stop of a multi-stop trip, we assume that the vehicle chooses the next stop to visit, based on current traffic conditions. Travel time along each arc in the network is modeled as a random variable, and we assume that network congestion dynamics can be described by a stationary Markov chain. We propose an efficient algorithm for determining the next stop to visit in a multi-stop tour, using action elimination procedures and a rolling forecast horizon.

2 - A Case Study for Time-dependent Routing Planning with Time Windows

Qian An, PhD Candidate, University of Southern California, Los Angeles, CA, 90007, United States of America, qan@usc.edu, James Moore, Ugur Demiryurek, Cyrus Shahabi

In this paper we study the importance of time-dependent route planning as opposed to static planning. A time-dependent network dataset of the entire Los Angeles County highways and arterial streets is used. It includes 6300 traffic sensor data with update rate of every 1 minute covering approximately 3000 miles. With extensive experiments we show that time-dependent planning could save 9% as compared to static planning in uniform time window cases, and 20% in random time window cases.

3 - A Hierarchical Agent-based Simulation for Traveler Behaviors

Yiheng Feng, University of Arizona, 1127 E. James E. Rogers Way, P.O. Box 210020, Tucson, AZ, 85705, China, yihengfeng@email.arizona.edu, Hui Xi, Sojung Kim, Young-Jun Son, Larry Head

A hierarchical agent-based framework is proposed to model the travelers' behaviors with route choice on the upper level and tactical driving on the lower level. The route choice level considers learning from previous experiences, heterogeneity of different travelers, and incomplete network information, while the tactical driving level concerns car-following and lane changing behaviors. Results from the proposed models are shown to reach the same user equilibrium solutions as in the literature.

4 - Path and Multi-step Ahead Freeway Travel Time Prediction

Wenxin Qiao, University of Maryland-College Park, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, wxqiao@umd.edu, Ali Haghani

This research utilized multiple data sources to predict freeway travel times through an integrated model based on large historical traffic and weather information dataset, along with real time traffic information. This model is proposed to perform path and multi-step ahead travel time prediction. Numerical experiments are conducted and comparison results of different models' performances are presented as well as sensitivity analysis on the efficient size of the historical dataset.

5 - Scenario Generation in Freeway Reliability Analysis
Behzad Aghdashi, Research Assistant, North Carolina State University, 2510-203 Avent Ferry Rd, Raleigh, NC, United States of America, saghdas@ncsu.edu

Scenario Generation is primary step in evaluating freeway's travel time reliability. In this research different mathematical modeling challenges are discussed. The main focus of this research is to minimize the error and bias imposed by modeling incidents and weather events.

■ SC43

43- North 228 A- CC

Joint Session RAS/CPMS: Panel Discussion: Analytics and Intermodal

Sponsor: Railway Applications & CPMS, The Practice Section

Sponsored Session

Chair: Bruce Patty, Vice President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, bpatty@veritecsolutions.com

1 - Roundtable on Analytics and Intermodal
Moderator: Bruce Patty, Vice President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, bpatty@veritecsolutions.com, Panelists: Gino Phillips, Craig Littzen, Vernon Prevatt

This roundtable will take place during two sessions. During this first session, there will be three panelists from the Intermodal industry (Gino Phillips from APL, Craig Littzen from Swift, and Vernon Prevatt from CSX) who will share their thoughts about current and potential applications of analytics to the intermodal industry. After their opening presentations, there will be an opportunity for the audience to ask questions and participate in an open discussion.

■ SC44

44- North 228 B- CC

Contracts in Supply Chain

Contributed Session

Chair: Arnab Bisi, Associate Professor of Operations Management, Indian Institute of Management Calcutta, Joka, Kolkata, 700104, India, abisi@iimcal.ac.in

1 - Optimization of Supplier and Customer Strategies under Options Contract and Unknown Pricing/Demand
Matan Shnaiderman, Bar-Ilan University, Ramat-Gan, 52900, Israel, shnidem@biu.ac.il, Avi Ceder

This work develops optimal strategies of a supplier and customers when using options contract. One supplier sells goods for two customers. The supplier uses option contracts, for extending profits, such that the customers have the possibility to purchase options in advance and being the first to receive the production. The stochastic demands at the customers' sites are continuously distributed. We show that customers who receive high profits, are interested to buy the options and exercise them.

2 - Operations and Marketing Equilibrium Strategies under Wholesale Price and Revenue Sharing Contracts
Fouad El Ouardighi, Professor, ESSEC Business School, Av. B. Hirsch, Cergy Pontoise cedex, 95021, France, elouardighi@essec.fr, Dieter Grass, Steffen Jorgensen, Gary Erickson

The paper studies the relative merits of two specific contracts, the wholesale price and the revenue sharing contract in a dynamic vertical channel with one manufacturer and one retailer. We consider decisions that develop from Nash equilibria. Two different strategies are available to the players, i.e., open-loop and feedback Nash equilibrium strategies. We compare how these different strategies affect the players' decisions and payoffs under wholesale price and revenue sharing contracts.

3 - The Impact of Supplier Innovation on Contract Efficiency
Xiaolu Zuo, PhD Student, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, Hong Kong-PRC, zuoxiaolu29@gmail.com, John Liu

Consider in a one supplier-one retailer supply chain setting, the supplier experiences process improvement, reflected by the production cost reduction, which follows a discrete dynamic way. We analyze the impact of supplier innovation on the efficiency of supply chain contract and give an explanation for the incentive of supplier innovation.

4 - Wholesale-price Contracts with Postponed and Fixed Retail Price
Arnab Bisi, Associate Professor of Operations Management, Indian Institute of Management Calcutta, Joka, Kolkata, 700104, India, abisi@iimcal.ac.in, Yanyi Xu

We study wholesale-price contracts with retail price-postponement in a supply chain consisting of one manufacturer and one retailer. For additive and multiplicative demand models, we establish sufficient conditions for the unimodality of profit functions and derive the unique optimal solutions. We also extend existing results on the fixed retail price case and a revenue management problem.

■ SC45

45- North 229 A- CC

Joint Session MI/HAS: Operations Research in Patient Safety and Care Quality

Sponsor: Minority Issues & Health Applications Society

Sponsored Session

Chair: Laila Cure, Assistant Professor, Western Michigan University, 4601 Campus Dr., Kalamazoo, MI, 49008-5336, United States of America, laila.cure@wmich.edu

1 - A Multiple-drawer Medication Layout Problem in Automated Dispensing Cabinets
Jennifer Pazour, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, Jennifer.Pazour@ucf.edu, Russell Meller

We investigate the problem of locating medications in automated dispensing cabinets to minimize human selection errors. We formulate the multiple-drawer medication layout problem as a quadratic assignment problem. As a way to evaluate various medication layouts, we develop a similarity rating for medication pairs. To solve industry-sized problem instances, we develop a heuristic approach.

2 - A Decision Support Model for the Location of Hand Sanitizer Dispensers in Hospitals Units
Laila Cure, Assistant Professor, Western Michigan University, 4601 Campus Dr., Kalamazoo, MI, 49008-5336, United States of America, laila.cure@wmich.edu

Noncompliance with hand hygiene guidelines is a cause of infection in hospitals. To improve compliance, hand sanitizer dispensers should be placed in convenient locations, but fire safety regulations constrain their number and distribution. We develop a model to incorporate guidelines, regulation, and hospital characteristics into the dispenser installation decision. The proposed model can help in evaluating the current locations of dispensers and in determining the best possible configuration.

3 - A Hub Infrastructure to Reduce Infusion Pump Medication Errors in Hospitals
Kenneth Musselman, Strategic Collaboration Director, Regenstrief Center for Healthcare Engineering, Purdue University, Mann Hall, Suite 225, 203 Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, kmusselm@purdue.edu

Reliable, timely and low cost data collection is necessary to achieve a significant reduction in hospital medication errors. The Infusion Pump Informatics (IPI) System, which was developed using a hub infrastructure, allows infusion pump data to be readily accessible, meaningful and actionable. Participating hospitals are now forming virtual communities that exchange information, share analysis results, trigger research, and collaborate on ways to improve patient safety.

4 - Prediction, Non-clinical Factors and Intervention in Unnecessary Hospital Readmissions
Brandon Pope, Purdue University, 315 N. Grant Street, West Lafayette, IN, United States of America, popeb@purdue.edu

Unnecessary readmissions waste $17 B per year in U.S. hospitals on Medicare patients alone. In this presentation we focus on calibrating predictive models using nearly 400,000 discharges over a 3.5 year span from a network of 11 U.S. hospitals. We also examine the relative importance of non-clinical factors in readmission rates. Motivated by financial reform, we model the discharge intervention problem, highlighting the possibility of unintuitive optimal policies, and opportunities for research.

■ SC46

46- North 229 B- CC

Organizational and Industry Renewal (III): Leadership, Team Management, and Organizational Learning

Sponsor: Organization Science

Sponsored Session

Chair: Andreas Schwab, Associate Professor, Iowa State University, 3315 Gerdin, Ames, IA, 50011, United States of America, aschwab@iastate.edu

1 - Schematic Inertia: A Dynamic and Complexity Pespective on Sared Cognition

Benjamin Herndon, Assistant Professor, Georgia Institute of Technology, 800 W. Peachtree St., NW, Atlanta, GA, 30308, United States of America, benjamin.herndon@mgt.gatech.edu, Kyle Lewis

This paper extends theories of socially shared cognition by forwarding a framework to explain how – over time – teams are affected by dynamic and residual schema and dimensions of shared cognition. We articulate these dimensions and consider how they form, accrue and decay as team tasks and boundaries change over time. Finally, we posit relationships between these dimensions and a team's ability to realize performance synergy or dissonance on the task at hand.

2 - Exploring the Role of Culture in Psychological Safety and Team Learning

Mary Zellmer-Bruhn, Associate Professor, University of Minnesota, 321 19th Ave., S, Minneapolis, 55455, United States of America, zellm002@umn.edu

Psychological safety is vital to internal and external team learning. Given differences in behavioral expectations across cultures, evidence that work-related constructs may carry different meaning across cultures, and increases in globally distributed work, examining psychological safety in different cultural settings is a valuable avenue for research. This paper presents an exploratory framework for the role of culture and language differences in team psychological safety.

3 - An Exploration of Inter-Organizational Heterogeneity in Organizational Goal Setting

Cynthia Penaflor, Research Assistant, Brigham Young University, 2112 Margalene Way, Austin, TX, 78728, United States of America, cynthiapenaflor@gmail.com, Peter Madsen

Limited availability of data on organizational goals has necessitated the imputation of organizational goals in empirical tests of the behavioral theory of the firm; but this approach cannot account for inter-organizational heterogeneity in goal setting. Our project plans to overcome this challenge by analyzing newly-available data from all companies that have been members of the S&P 500 index from 2006-2011. We test how closely imputed goals approach self-reported organizational goals.

4 - Shared Leadership: The Impact of the Occupy Movement on Decision Making in Organizations

Adina Lav, Doctoral Student, George Washington University, 2480 16th Street, NW #445, Washington, DC, 20009, United States of America, adinalav@gwmail.gwu.edu

Social and political movements around the globe witnessed over the past year are great examples of the changes taking place in how people learn from each other and express their leadership at the societal level. This oral presentation describes the Occupy movement and its organic development of consensus building and shared leadership and calls for organizations to broaden their perspectives of decision making by understanding new ways in which leadership and consensus-building takes place.

■ SC47

47- North 230- CC

Travel Time Estimation and Applications

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Xuesong Zhou, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Predicting Corridor-level Travel Time Distributions Based on Stochastic Flow and Capacity Variations

Hao Lei, Phd Student, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, hao.lei@utah.edu, Xuesong Zhou

This research aims to establish a point-queue based end-to-end travel time prediction method on a corridor with multiple merges and diverges. A set of analytical equations is developed to calculate the number of queued vehicles ahead of the probe vehicle and further capture many important factors affecting end-to-end travel times.

2 - On the Link Travel Time Imputation Methods

Lei Zhu, Graduate Research Assisant, University of Arizona, 1209 E 2nd street, RM 324J, Tucson, AZ, 85721, leizhu@email.arizona.edu, Yi-Chang Chiu

Link travel time imputation is important for shortest path algorithms under a certain circumstance. Based on traffic flow conservation law and the average flow theorem, the missing travel time can be estimated by flow of adjacent upstream and downstream road segments. In this research, the missing link travel times are categorized into several conditions and the proposed imputation methods have been shown to deal with each condition effectively.

3 - ParkPGH: Pittsburgh's Predictive Parking App

Tayo Fabusuyi, Lead Strategist, Numeritics, 5907 Penn Ave., Suite 313, Pittsburgh, PA, 15206, United States of America, Tayo.Fabusuyi@numeritics.com, Robert Hampshire, Katsunobu Sasanuma

ParkPGH is a smart parking solution that provides information on the availability of parking spaces within Pittsburgh's downtown. The application uses an event calendar, historical data, multiple regression model and a Bayesian updating process in making both long and short term predictions about parking availability. Parking information is delivered through channels that include websites, SMS text, voice, iPhone app and a mobile version of the website that is optimized for other smartphones.

4 - Quantification of the Benefits of Real-time Information for Individual Travelers

Dongyoon Song, NEXTRANS Center, USDOT Region V Regional UTC, School of Civil Engineering, Purdue University, West Lafayette, IN, 47906, United States of America, song50@purdue.edu, Srinivas Peeta

This study seeks to quantify the benefits of real-time travel information in terms of both conventional travel time savings as well as psychological effects for individual travelers. Revealed preference (RP) data from an experiment with a driving simulator and stated preference (SP) data from a survey will be utilized in behavioral analysis to estimate the value of the real-time information.

■ SC48

48- North 231 A- CC

Traveling Salesman Problem with Time Windows

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Amelia Regan, University of California, Irvine, CA, United States of America, aregan@uci.edu

1 - Hybrid Parallel Metaheurustics for the Traveling Salesman Problem with Time Windows

Amelia Regan, University of California, Irvine, CA, United States of America, aregan@uci.edu, Dmitri Arkhipov

Our work examines a novel way to parallelize the TSPTW problem.

2 - The Probabilistic Travelling Salesman Problem with Time Windows

Stacy Voccia, University of Iowa, Iowa City, IA, United States of America, stacy-voccia@uiowa.edu, Barrett W. Thomas, Ann M. Campbell

We introduce the Probabilistic Traveling Salesman Problem with Time Windows (PTSPTW), where in addition to stochastic customer presence, each customer has an associated time window during which deliveries must be made. We present a recourse model and a Variable Neighborhood Search (VNS) algorithm to solve problem instances. Using computational experiments, we demonstrate the value of incorporating stochasticity into the model.

3 - A Branch-and-Price Approach for Vehicle Routing with Soft Time Windows and Stochastic Travel Times

Duygu Tas, TU/e Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, D.Tas@tue.nl, Michel Gendreau, Tom van Woensel, Nico Dellaert, Ton de Kok

We study a vehicle routing problem with soft time windows and stochastic travel times. In our problem setting, we have for each node, except the depot, a known demand, a fixed service duration and a soft time window. Our objective is to minimize the sum of transportation costs and service costs. We apply a column generation procedure to solve our model. To generate an integer solution, we embed our column generation procedure within a branch-and-price method.

4 - A Divide-and-conquer Analysis of Very Large Asymmetric Vehicle Routing Problems

Dauwe Vercamer, Ghent University, Ghent, 9000, Belgium, Dauwe.Vercamer@ugent.be, Birger Raa, Dirk Van den Poel

When working with extremely large datasets in real-life VRPs, solution neighborhoods must be kept simple in order to obtain reasonable process times. By dividing the set into smaller samples, more elaborate neighborhoods can be explored or the total process time can be reduced. However, this also limits the optimization. Our research investigates the impact of using these smaller samples on the solution quality and provides approaches for overcoming the downsides of the division.

5 - A Multi-terminal Truckload Pickup and Delivery Problem with Time Windows in a Dynamic Context

Hossein Zolfagharinia, Wilfrid Laurier University, 1207-125 Lincoln Road, Waterloo, ON, N2J 2N9, Canada, zolf1380@wlu.ca, Michael Haughton

We study a dynamic full truckload pickup and delivery problem with time windows. In this work, we explicitly address the role of terminals in designing a dispatching rule in which driving hours regulations are taken into account. We show how the model can be mathematically formulated and efficiently solved.

■ SC49

49- North 231 B- CC

Joint Session TSL/SPPSN: From Emergency Preparedness to Debris Cleanup

Sponsor: Transportation Science & Logistics & Public Programs, Service and Needs

Sponsored Session

Chair: Changhyun Kwon, Assistant Profesor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu

1 - Innovative Cycle Canceling Algorithm for Routing of Evacuees in Networks with Multiple Threat Zones

Neema Nassir, Graduate Research Assistant, University of Arizona, Department of Civil Engineering and Engineering Mechanics, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, neeman@email.arizona.edu, Mark Hickman, Yi-Chang Chiu, Hong Zheng

An exact algorithm is developed and tested for finding the optimal routing of traffic flows, to evacuate a network with several threat zones, where the threat level may depend on the exposure or risk in each zone. A network transformation is proposed that facilitates detecting flow-augmenting paths, in which the cycles with the highest negative costs are quickly identified.

2 - Dual-Toll Pricing and Drivers' Preferences in Hazardous Materials Transportation Regulation

Changhyun Kwon, Assistant Profesor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu, Tolou Esfandeh, Masoumeh Taslimi, Rajan Batta

A dual-toll setting policy is used as an effective and flexible regulation tool to encourage the carriers to route shipments on low risk paths. The proposed model not only aims to minimize the total risk on the network but also to consider the drivers' preferences and priorities in route selection based on toll prices and travel time. Risk measurement model entails the risk in terms of overall accident probability and the consequences of the accident occurrence.

3 - Robust Shelter Location in Geographic and Building Environments

Elise Miller-Hooks, Professor, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, elisemh@umd.edu, Shabtai Isaac, Lei Feng, Reza Faturechi

A bilevel, integer stochastic program is presented for the robust shelter location problem in geographic and building environments. At the upper level, the optimal location and size of shelters is chosen to support evacuation given an event requiring building occupants or individuals in the region to seek egress or protective covering. Individuals choose egress routes to these safe locations in the lower level to minimize disutility (travel time, exposure, geometric considerations, ...).

4 - Post-disaster Debris Recycling and Disposal

Alvaro Lorca, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, alvarolorca@gatech.edu, Pinar Keskinocak, Ozlem Ergun

The large volumes of debris generated by disasters can generate severe long term financial and environmental problems to the affected communities if not handled appropriately. We study the impact of strategic decisions in the collection and disposal phases of post-disaster debris management such as recycling, collecting debris separately and incinerating debris, on the tradeoff between financial costs and environmental issues.

■ SC50

50- North 231 C- CC

Raytheon (USA) and Brazilian Navy Defense Applications

Sponsor: Military Applications

Sponsored Session

Chair: George Blaha, Senior Principal Systems Engineer, Raytheon Integrated Defense Systems, 2461 S. Clark St. #1100, Arlington, VA, 22202, United States of America, gblaha@raytheon.com

1 - Data Association using Fuzzy Knowledge

Cleber Oliveira, DSc, Brazilian Navy, Ilha de Mocangue s/n, Niteroi, 24040-300, Brazil, cleber.almeida@casop.mar.mil.br

This paper presents a maritime tactical picture, which was assembled by the association of the reports from surface targets provided by multiple sensors of a Brazilian vessel. The decision-making process conjugates the gating technique and the conceptual structure of decisions in a fuzzy environment to solve the data association problem considering four dimensions.

2 - Leveraging Mission Analysis and Modeling to Investigate Conceptual CG VOI Location Decision Support

David Procter, Raytheon Integrated Defense Systems, 225 Presidential Way, Woburn, MA, United States of America, david_procter@raytheon.com, Fred Mott

This paper presents the approach and results of a joint Raytheon - U.S. Coast Guard mission analysis and experiment to evaluate mission analysis-derived decision support concepts supporting USCG missions. The objective was to identify and investigate, via mission analysis and modeling, the potential of candidate decision support aids and CONOPS to enhance maritime security. Raytheon's Mission Profiling (Patented) approach was applied to a conceptual vessel of interest (VOI) location application.

3 - Sensor Scheduling for Space Event Identification and Characterization

George Blaha, Senior Principal Systems Engineer, Raytheon Integrated Defense Systems, 2461 S. Clark St. #1100, Arlington, VA, 22202, United States of America, gblaha@raytheon.com, Christopher Cox, Michael Schmidt

Timely identification and characterization of space events (e.g. breakups, maneuvers, conjunctions, dockings) requires effective scheduling of Space Surveillance Network (SSN) sensors. We present techniques for modeling event characterization peformance and quantifying the need for improved data collection. Combined with needs-based scheduling, these techniques may be used to develop effective observation schedules. Application to the current and planned SSN architecture is considered.

■ SC51

51- North 232 A- CC

Joint Session MAS/SPPSN: Defense Operations and Homeland Security I

Sponsor: Military Applications & Public Programs, Service and Needs

Sponsored Session

Chair: Anna Doro-on, Sr. Consultant/Project Engineer, Water, Tunnel & Infrastructure Concepts, Inc., 120 S. Euclid Avenue, Pasadena, CA, 91101, United States of America, anna@annaforhomelandsecurity.com

1 - Military Support for Homeland Security: Iranian WMD

Anna Doro-on, Sr. Consultant/Project Engineer, Water, Tunnel & Infrastructure Concepts, Inc., 120 S. Euclid Avenue, Pasadena, CA, 91101, United States of America, anna@annaforhomelandsecurity.com, Martin Hershkowitz

Iranian weapons of mass destruction (WMD) is a threat against United States, that has created the government to initiate both military and civil support. This paper demonstrates risk assessment based on cumulative prospect theory, analyzes the alternatives for effectiveness of military operations in the event of attacks for risk acceptability.

2 - Optimization Models for Improvements to Civil Infrastructure Systems Subject to Natural Hazards
Brian Piper, North Carolina State University, 2500 Stinson Drive, Raleigh, NC, United States of America, bepiper@ncsu.edu, Ranji Ranjithan

We present optimization models to improve the resilience of a civil infrastructure system (CIS) subjected to natural hazards. The engineering improvements considered reduce the risk to the CIS by either limiting consequences or reducing their associated probabilities. The uncertainties inherent to future natural hazards are represented by hazard scenarios. The models are applied to realistic data from a coastal community to demonstrate the value of a system-wide approach to the CIS improvements.

3 - Dividing a Territory with Obstacles
Raghuveer Devulapalli, Research Assistant, University of MInnesota, 310 8th St SE #205, MInneapolis, MN, 55414, India, devul002@umn.edu, John Carlsson

We consider the problem of dividing a territory into sub-regions so as to balance workloads of n fixed facilities over that territory. We assume that the territory is a simply connected polygon containing a set of simply connected obstacles. We give a fast analytic center cutting plane method that divides the territory into n compact, connected sub-regions, each of which contains a facility, such that the workloads in each sub-region are balanced.

4 - Optimal Selection of Countermeasures in IT Security Planning
Tadeusz Sawik, Professor, AGH University of Science & Technology, Department OR & IT, Al.Mickiewicza 30, Krakow, 30059, Poland, ghsawik@cyf-kr.edu.pl

A mixed integer programming and conditional value-at-risk are applied for selection of countermeasure portfolio in IT security planning to prevent or mitigate cyber-threats. Given a set of potential threats and a set of available countermeasures, the selection of countermeasures is based on their effectiveness of blocking different threats, implementation costs and probability of potential attack scenarios.

■ SC52

52- North 232 B- CC

Renewable Energy Integration Strategies

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Seyed Madaeni, PhD Candidate, The Ohio State University, 210 Baker Systems Engineering Building, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, madaeni.1@osu.edu

1 - Optimal Location of Wind Power Capacity: A Point-estimate Solution Approach
Salvador Pineda, Technical University of Denmark, DTU Electrical Engineering, Elektrovej, Kongens Lyngby, 2800, Denmark, spmo@elektro.dtu.dk, Juan Miguel Morales

We present a tool for a generating company to optimally decide on the investment in new wind power capacity. The tool is formulated as a stochastic mathematical program with equilibrium constraints, which is hard to solve. We propose a point-estimate solution approach that effectively captures the information embedded in the probability distributions of the uncertain parameters, while remarkably trimming down the computational burden of the model.

2 - A Nash Equilibrium Method to Control Plug-in Electric Vehicle Charging with Wind Integration
Xiaomin Xi, The Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xi.12@osu.edu, Ramteen Sioshansi, Vincenzo Marano

We apply a decentralized method using Nash Equilibrium to control plug-in electric vehicle (PEV) charging so as to reduce the negative effect of wind uncertainty. A economic dispatch model and a cost minimization problem are solved iteratively, in which SO sends scenario-based prices to a load aggregator (LA) that represents PEV owners, and LA submits bids by minimizing expected charging cost plus a penalty term. Convergence is assured under certain rules but is not necessarily social optimum.

3 - Quantifying Variability and Uncertainty Metrics for Wind and Solar Power
Patrick Sullivan, National renewable Energy Laboratory, Golden, CO, 80401, United States of America, Patrick.Sullivan@nrel.gov

Using the ReEDS capacity-expansion model as a backdrop, we present statistical methods for quantifying variability and uncertainty of wind and solar power across an interconnected grid. Algorithms that estimate capacity value, operating reserve requirements, and curtailment levels describe the impact of resource variability on the electric sector and inform model investment decisions.

4 - Capacity Value of Photovoltaic Power
Seyed Madaeni, PhD Candidate, The Ohio State University, 210 Baker Systems Engineering Building, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, madaeni.1@osu.edu, Paul Denholm, Ramteen Sioshansi

In this study we focus on capacity value of Photovoltaic (PV) power and compare techniques that can be used for this purpose. These techniques consist of either reliability and statistical methods used to estimate the probability of a system outage event or simpler approximation techniques. We further investigate the effect of including subhourly data in our analysis.

■ SC53

53- North 232 C- CC

Real Options in the Energy Sector

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Afzal Siddiqui, University College London, Gower Street, London, United Kingdom, afzal.siddiqui@ucl.ac.uk

1 - Economics of High-temperature Reactors for Industrial Cogeneration: A Utility's Perspective
Reinhard Madlener, Professor of Energy Economics and Management, RWTH Aachen University, Mathieustrasse, Aachen, 52074, Germany, RMadlener@eonerc.rwth-aachen.de, Jona Hampe

We study the economics of high-temperature reactors (HTR) for nuclear cogeneration, based on a business model developed from a utility's perspective. For the economic evaluation, we perform a discounted cash flow (DCF) analysis, followed by a real options analysis (ROA) used to determine the value of the utility's flexibility to react to market changes. We investigate both the option to delay the investment and the option to switch power plant operation from cogeneration to power-only mode.

2 - Switching Options: Empirical Evidence from the Electricity Industry
Stein-Erik Fleten, Professor, Norwegian University of Science and Technology, Industrial Economics and Technology Mgmt., Alfred Getz v 3, Trondheim, NO-7491, Norway, stein-erik.fleten@iot.ntnu.no, Carl Ullrich, Erik Haugom

We examine empirically the real options to shutdown, startup, and abandon peaking power plants. The unique dataset details information for 1,337 individual plants for the period 2001–2009. Reduced form regressions provide evidence of real options effects for shutdown and abandonment decisions. Moreover, uncertainty about the outcome of ongoing deregulation in retail electricity markets significantly decreases the likelihood of shutting down operating plants.

3 - Sequential Investment, Capacity Sizing, Dividing Flexibility
Ryuta Takashima, Chiba Institute of Technology, Chiba, Japan, takashima@sun.it-chiba.ac.jp, Kimitoshi Sato, Yuta Naito

We consider the problem of a typical investor who has discretion over not only the timing, but also the sizing of a new plant in sequential manner. We contrast the sequential investment strategies for different stage numbers in order to the value of flexibility. Additionally, we analyze the sequential investment for a case in which there exists a fixed cost in the investment one. The optimal stage numbers of sequential investment are obtained for various fixed coasts.

4 - Investment in Alternative Energy Technologies under Physical and Policy Uncertainty
Afzal Siddiqui, University College London, Gower Street, London, United Kingdom, afzal.siddiqui@ucl.ac.uk, Ryuta Takashima

Policymakers have often backed alternative energy technologies, e.g., nuclear power, due to their relatively low operating costs and emissions. However, they have also been quick to respond to public perceptions about the safety of such plants by suspending construction or even decommissioning existing facilities. We address public concerns about physical plant risks along with stochastic market prices for energy in modelling investment and decommissioning of alternative energy technologies.

■ SC54

54- Regency Ballroom A- Hyatt

Memorial Sloan-Kettering Cancer Center - 2012 INFORMS Prize Winning Organization

Cluster: 2012 INFORMS Prize

Invited Session

Chair: Michael Gorman, University of Dayton, Dayton, OH, United States of America, michael.gorman@udayton.edu

1 - Memorial Sloan-Kettering Cancer Center - 2012 INFORMS Prize Winning Organization

Sasha Bartashnik, Memorial Sloan-Kettering Cancer Center, 405 Lexington Avenue, 3rd Floor, New York, NY, 10174, United States of America, bartasha@mskcc.org

Memorial Sloan-Kettering Cancer Center (MSK) is the oldest and one of the largest cancer hospitals in the world - over 25,000 patients come to MSK for treatment every year. The changing health care landscape presents a unique challenge for hospital administrators in providing better quality care at lower cost. Increasing demand against tighter resource constraints reinforces the institution's focus on their mission: better outcomes for patients. These challenges, as well as MSK's high volume of longitudinal care, create an opportunity to develop a fundamental platform for using quantitative methods to gain operational, strategic, and clinical insights. In 2006 MSK established the department of Strategic Planning and Innovation (STPI) based on the idea that better patient care means finding financially sustainable, patient-centered solutions. By working at the intersection of leadership, clinical staff, and physicians, STPI integrates OR/MS concepts within the hospital. Quantitative analysis, industrial engineering and design research teams collaborate to find innovative approaches to some of the hospital's most difficult challenges, including improving process flow, modeling resource utilization, and introducing a volume forecasting system. MSK continues to push the frontiers of cancer care as it partners with IBM to use powerful machine learning technology to develop a comprehensive evidence-based medical intelligence engine.

■ SC55

55- Regency Ballroom B - Hyatt

Healthcare Applications

Cluster: Operations Research in Emerging Economies

Invited Session

Chair: Janny Leung, Professor, Chinese University of Hong Kong, System Eng. and Engineering Management, Shatin, New Territories, Hong Kong - PRC, jleung@se.cuhk.edu.hk

1 - A Tracking Study in Medical Wards using RFID

Ziye Zhou, The Chinese University of Hong Kong, Dept. of Syst. Eng. & Eng. Mgmt., Shatin, NT, Hong Kong, Hong Kong-PRC, zhouzy@se.cuhk.edu.hk, Chun-Hung Cheng, Dorbin Tobun Ng

A large-scale tracking pilot study was conducted in two 40-bed Medical wards in a Hong Kong hospital since Fall 2011 for 6 months. This work is to illustrate how the tracking data were analyzed to support data-driven activity analysis & person-to-person contact tracing in the hospital ward environment.

2 - Evaluating Impacts of Staffing Policies on Patient Flows in an Emergency Department using Simulation

Yong Hong Kuo, The Chinese University of Hong Kong, SEEM Dept,Chinese Uni. of Hong Kong, Shatin, New Territories, Hong Kong, NT, Hong Kong-PRC, yhkuo@se.cuhk.edu.hk, Benedetta Lupia, Omar Rado, Colin Graham, Janny Leung

We studied impacts of staffing policies on patient flows in an Emergency Department in Hong Kong. We built a simulation model of the Emergency Department, which captures all relevant treatment processes, complicated arrival rates and adjustable staff deployment. To tackle a challenge of data incompleteness, we estimated required parameters in our model with the help of meta-heuristics. We will also present some insights and suggestions for operational improvements by using our model.

■ SC56

56- Curtis A- Hyatt

Entrepreneurship and Innovation I

Sponsor: Technology Management

Sponsored Session

Chair: Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest Park, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu

1 - Optimal Bargaining Power in an Entrepreneurial Market Process

Mohammad Keyhani, York University, 4700 Keele St., Schulich School of Business, Toronto, On, M3J 1P3, Canada, mkeyhani08@schulich.yorku.ca, Moren Lévesque

We investigate the role of bargaining power in the economic returns to agents engaged in repeated cooperative games over time representing an entrepreneurial market process in line with the Austrian economics of entrepreneurship. We find that as expected, players with greater bargaining power accrue greater returns under various conditions, but under certain conditions closer to the Kirznerian school of thought the pattern is more complicated and not necessarily monotonic.

2 - Are Innovative Companies also More Interactive? Evidence from Company Websites

John Angelis, Rochester Institute of Technology, 105 Lomb Memorial Drive, Rochester, NY, United States of America, jangelis@saunders.rit.edu, Rajendran SriramachandraMurthy

For innovative firms, interaction with customers may lead to improved innovation, but also may lower innovation efficiency. We assess firms ranked by innovation premium in Forbes Magazine's list of Top 100 Innovative Small-Cap Firms. Each website is evaluated on interaction opportunities for customers based on such areas as educational opportunities, co-creation options, and social media opportunities. We find strong industry-related impacts on innovation types selected by firms.

3 - Growth of New Business Ventures through Innovation Replicability

Juliana Hsuan, Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, jh.om@cbs.dk, Moren Lévesque

We propose a formal model of firm growth through replication that considers the extent of the investment to adapt routines as replication unfolds and the portion of this investment that goes toward innovation in the routines. Two growth policies for new business ventures emerge: bull-imitation and bear-innovation.

4 - Operations Design to Enhance ARPA-E Funding for Transformational Clean Technology Start-ups

Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest Park, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu, Jane Davies, Nitin Joglekar

This paper analyzes the role of operations design in securing funding for highly risky projects. We use data from 36 transformational innovative clean technology projects to examine to what extent the operational decisions can mitigate risk and enhance firm valuation during clean technology start-up. We find that operations design for risk reduction induces more funding, but design for market competitiveness shows significant negative correlation to level of funding.

■ SC57

57- Curtis B- Hyatt

Queueing Systems

Contributed Session

Chair: Philippe Chevalier, Professor, UCLouvain, core, 34 Voie du Roman Pays, Louvain-la-Neuve, 1348, Belgium, philippe.chevalier@uclouvain.be

1 - Interpolation Approximations for Many Single Queues in Series

Kan Wu, Assistant Professor, Nanyang Technological University, 50 Nanyang Ave., School of MAE, Singapore, 639798, Singapore, kan626@gmail.com, Leon McGinnis

We propose a new approximation approach, based on observed properties of the behavior of tandem queues, which we call the intrinsic gap and intrinsic ratio. The approach exploits what we call the nearly-linear and heavy-traffic properties of the intrinsic ratio, which appear to hold in realistic production situations. Across a broad range of examined cases, this new approach outperforms earlier approximation methods and offers a way to analyze the dependence among servers.

2 - A Queueing System with Service Phases of Random Length and Vacations
George Mytalas, Athens University of Economics and Business, 76 Patission Str., Athens 104 34, Athens, Greece, mytalas@aueb.gr, Michael Zazanis

We examine a queueing model with Poisson arrivals, vacations and service phases of random length with distributions with bounded or unbounded support. Standard techniques are used involving RouchÊ's theorem and Wiener-Hopf factorization techniques. We obtain our results under minimal assumptions, namely the finiteness of the first moment of the service and vacation distributions together with the stability condition.

3 - Real-time Delay Estimation in Multi-class Many-server Queueing Systems
Zinan Yi, PhD Student, North Carolina State University, Room 304, 1430 Collegeview Ave., Raleigh, NC, 27606-3133, United States of America, zyi@ncsu.edu, Yunan Liu, Rouba Ibrahim

We develop real-time delay estimators for multi-class queueing networks with general service and patience distributions, time-varying arrival rates and staffing functions, skill-based routing and global first-come-first-served service discipline. To construct these estimators, we adopt the corresponding many-server heavy-traffic fluid models. Computer simulation experiments verify that these estimators are effective.

4 - Efficient Queuing Network Structures with Limited Flexibility
Kuang Xu, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, kuangxu@mit.edu, John N. Tsitsiklis

We study a multi-server model where n flexible servers are connected to rn queues through a fixed connectivity graph, with average degree d. We show that as n tends to infinity, both a diminishing delay and a large capacity region are jointly achievable, even under limited flexibility (d << n): a family of random graphs are shown to stabilize all bounded admissible arrival rates, while simultaneously ensuring a diminishing queueing delay under a new class of matching-based scheduling algorithms.

5 - Mixed Loss and Queueing Systems: A New Kind of Multi-skill Model
Philippe Chevalier, Professor, UCLouvain, core, 34 Voie du Roman Pays, Louvain-la-Neuve, 1348, Belgium, philippe.chevalier@uclouvain.be, Jean-Christophe Van den Schrieck

We study a new type of multi-skill model, where some types of arrivals can wait in queue while other types of arrivals are lost if not served immediately. We consider static routing policies of arrivals to the different server pools. We compute the loss probability for arrivals that cannot wait; and the waiting probability and expected waiting time of arrivals that can wait. We present applications for contact centers and in healthcare.

■ SC58

58- Phoenix East- Hyatt

Learning and Multiarmed Bandits

Sponsor: Applied Probability

Sponsored Session

Chair: Ramesh Johari, Associate Professor, Stanford University, Stanford, CA, United States of America, ramesh.johari@stanford.edu

1 - Approximation Algorithms for Correlated Knapsacks and Non-martingale Bandits
R. Ravi, Carnegie Bosch Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ravi@andrew.cmu.edu, Anupam Gupta, Ravishankar Krishnaswamy, Marco Molinaro

We give constant-factor approximation algorithms for the stochastic knapsack problem with correlations and cancellations, and also for some budgeted learning problems where the martingale condition is not satisfied. We propose new time-indexed LP relaxations; using a decomposition and "shifting" approach, we use the LP values and the time ordering information from these strategies to devise a randomized scheduling algorithm.

2 - Mean Field Equilibria of Multiarmed Bandit Games
Ramki Gummadi, Stanford University, 475 Via Ortega, Stanford, CA, 94305, United States of America, gummadi@stanford.edu, Jia Yuan Yu, Ramesh Johari

We study a multiarmed bandit setting consisting of multiple agents, where the reward distributions depend on choices made by other agents. We consider a solution concept for the resulting bandit game inspired by a large agent population approximation called mean field eqilibrium. We obtain sufficient conditions for existence, uniqueness and approximation properties of such equilibria for a broad class of reward functions.

3 - Non-stationary Online Stochastic Optimization
Yonatan Gur, Columbia Business School, New York, NY, United States of America, ygur14@gsb.columbia.edu, Omar Besbes, Assaf Zeevi

We consider a stochastic approximation problem where the underlying response function can exhibit a broad array of temporal changes. We introduce a principle by which policies that are designed for adversarial environments can be systematically adapted to non-stationary stochastic environments (by judicious choice of tuning parameters) and exhibit essentially optimal performance.

4 - Efficient Reinforcement Learning for Deterministic MDPs
Zheng Wen, Stanford University, Stanford, CA, 94305, United States of America, zhengwen@stanford.edu, Benjamin Van Roy

We present a reinforcement learning algorithm for finite-horizon deterministic Markov decision processes. This algorithm generalizes using function approximation and strikes an effective balance between exploration and exploitation. This algorithm is efficient in the sense that in the worst case, the number of episodes over which it experiences suboptimal reward equals the number of basis functions.

■ SC59

59- Phoenix West- Hyatt

Optimization via Simulation

Sponsor: Applied Probability

Sponsored Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 106 Burleigh Dr, Ithaca, NY, 14850, United States of America, pf98@cornell.edu

1 - Probabilistic Bisection Search for Stochastic Root-finding
Rolf Waeber, Cornell University, 206 Rhodes Hall, Ithaca, NY, 14853, United States of America, rw339@cornell.edu, Peter Frazier, Shane Henderson

We investigate a one-dimensional stochastic root-finding algorithm that is motivated by the bisection algorithm. At each measurement point the algorithm collects enough information about the underlying function such that a posterior density, which reflects in some sense one's belief about the location of the root, can be updated. We discuss some convergence results and show how this algorithm, in addition to a point estimate, also provides a confidence interval of the root.

2 - Simulation-based Optimization over Discrete Sets with Noisy Constraints
Eunji Lim, Assistant Professor, University of Miami, 1251 Memorial Drive, Coral Gables, FL, 33124, United States of America, lim@miami.edu, Yao Luo

We consider a constrained optimization problem over a discrete set, where only noise-corrupted observations of the objective and constraints are available. We propose a new method that converts constrained optimization into unconstrained optimization of finding a saddle point of the Lagrangian. The method then applies stochastic approximation to the Lagrangian in search of the saddle point. The proposed method is provably convergent under suitable conditions. We also present numerical examples.

3 - Optimization of Computationally-expensive Simulations with Low-dimensional Randomness
Jing Xie, Cornell University, Rhodes Hall, Ithaca, NY, 14850, United States of America, jx66@cornell.edu, Peter Frazier, Saleh Elmohamed, Alison Marsden

In many applications of simulation optimization, the random output variable whose expectation is being optimized is a deterministic function of a low-dimensional random vector. This deterministic function is often expensive to compute, making simulation optimization difficult. Motivated by an application in the design of grafts for heart surgery, we use Bayesian methods to design an algorithm that exploits this random vector's low-dimensionality to improve performance.

■ SC60

60- Remington- Hyatt

Efficient Models and Algorithms for Air Traffic Flow Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Vikrant Vaze, Member Research Staff, Philips Research North America, 345 Scarborough Road, Briarcliff Manor, NY, 10510, United States of America, vikrant.vaze@philips.com

1 - Equipage-based Resource Allocation in Air Traffic Flow Management

Shervin AhmadBeygi, Lead Operations Research Analyst, Metron Aviation Inc., 45300 Catalina Ct, Dulles, VA, 20166, United States of America, shervin.ahmadbeygi@metronaviation.com

Successful implementation of the Next Generation Air Transportation System (NextGen) requires a critical mass of aircraft to be equipped with a range of communication, navigation, and surveillance avionics. In this research we study different mechanisms to incorporate equipage information in Traffic Flow Management resource allocation algorithms.

2 - A Decomposition Approach for the Stochastic ATFM Problem

L. Corlli, University of Milano-Bicocca, Department Informatics Systems Communication, Milano, 20126, Italy, corolli@disco.unimib.it, Lewis Ntaimo, Guglielmo Lulli

The stochastic Air traffic Flow Management (ATFM) problem is now attracting a lot of interest from the research community. In this talk, we present a two-stage stochastic integer programming formulation for the problem, which balance the trade-off between the complexity of the model and its representation of reality. To solve the problem, we present a decomposition approach to take advantage of the underlying structure of the problem.

3 - Applying Air Traffic Flow Management Optimization Models to Railroad Train Scheduling

Lingyun Meng, School of Traffic and Transportation, 8507D, No.8 Teaching Building, No.3 ShangYuanCun, HaiDian District, China, lymeng@bjtu.edu.cn, Xuesong Zhou

By analyzing a variety of air traffic flow management models, this paper proposes a cumulative flow count based optimization model for train scheduling problem under stochastic segment capacity breakdowns. The "capacity aggregation" technique is used to capture the uncertainty of capacity breakdown incidents. A Lagrangian relaxation based solution approach is presented to solve this model. Numerical experiments are conducted to demonstrate the performance of the proposed solution approach.

4 - Application and Evaluation of Bibliometrics Methods for ATM Researches

Hidenori Chida, University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo, Japan, hidenori.chida@gmail.com, Katsuhiro Nishinari, Hiroko Nakamura

Innovation in ATM (air traffic management) is expected to afford rapidly increasing air traffic more efficiently and safely. To implement the innovation, interdisciplinary cooperation is required in ATM researchers such as with civil engineering or navigation research of other transportation. Therefore, we applied and evaluated a bibliometrics method to get overviews of areas unknown to ATM researchers, and to support effective and strategic ATM development.

■ SC61

61- Russell- Hyatt

Airport Operations

Sponsor: Aviation Applications

Sponsored Session

Chair: Mourad Boudia, Research Engineer, Amadeus, 485, Route du Pin Montard BP 69, Sophia Antipolis, 06902, France, mourad.boudia@amadeus.com

1 - Pre-departure Sequence Planning

Mourad Boudia, Research Engineer, Amadeus, 485, Route du Pin Montard BP 69, Sophia Antipolis, 06902, France, mourad.boudia@amadeus.com, Olivier Ratier, Baptiste Chatrain

High performance departure sequence planning contributes to improve air traffic and aircraft operations at airports by maximizing usage of available runways. We present here an innovative approach based on linear programming and discuss its contribution and performances.

2 - Aircraft Stand Allocation with Associated Resource Scheduling

Tor Fog Justesen, Industrial PhD Student, Copenhagen Airports A/S, Lufthavnsboulevarden 6, P.O. Box 74, Kastrup, 2770, Denmark, tor.justesen@cph.dk, Richard Lusby, Jesper Larsen, David Ryan

When handling an aircraft turnaround different ground handling resources are required at different times. Each resource can be claimed by at most one turnaround at a time. In this project we develop a set partitioning model formulation of the aircraft stand allocation problem with associated resource scheduling and an optimization based solution algorithm in which knowledge about the structure of the problem is exploited to generate good feasible solutions.

3 - Maximizing Resilience of Airport Runway and Taxiway Pavement Networks through Stochastic Programming

Reza Faturechi, PhD Candidate, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, reza@umd.edu, Xiaodong Zhang, Eyal Levenberg, Elise Miller-Hooks

A two-stage binary integer, stochastic program and integer L-shaped method proposed for its solution are presented for assessing and maximizing the resilience of an airport given the possibility of future, randomly arising events affecting airport runway and taxiway pavement networks. Their application provides insights into optimal allocation of limited resources for response and preparedness actions that facilitate them. The approach is demonstrated on a case study involving Laguardia Airport.

4 - Stand Allocation in Airports - New Solution Approaches and Results

Rodrigo Acuna Agost, Operations Research-Innovation, Amadeus, 485 Route du Pin Montard, Sophia Antipolis, 06902, France, rodrigo.acunaagost@amadeus.com, Mourad Boudia, Thierry Delahaye, Julien Guepet, Daniel Perez

The Stand Allocation Problem consists in finding an assignment of aircraft turnarounds to parking positions. The usual objectives include maximizing the number of passenger assigned to contact stands, and minimizing the number of tows. In this talk we show new methods including MIP-based, CP-based, Column Generation, and metaheuristics approaches. The results of experiments show significant improvements on several KPIs compared to the current practice on real data from two European airports.

■ SC62

62- Borein A - Hyatt

Automated Analysis and Design of Auctions

Cluster: Auctions

Invited Session

Chair: David Thompson, PhD Student, University of British Columbia, 191-2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, davidrthompson@gmail.com

1 - Automated Mechanism Design, with Applications to Auctions

Yevgeniy Vorobeychik, Sandia National Labs, 7011 East Ave., Livermore, CA, 94550, United States of America, eug.vorobey@gmail.com

We present general methods for automated mechanism design when both the design, and player strategy spaces are constrained. We offer Bayesian and worst-case ("robust") formulations, and present a technique based on stochastic search. Finally, we demonstrate the effectiveness of our methods in a variety of auction settings.

2 - Automated Mechanism Design using CAT Games

Jinzhong Niu, Postdoctoral Research Associate, The City College of New York, 160 Convent Avenue, New York, NY, 10031, United States of America, jniu@ccny.cuny.edu, Simon Parsons

In this paper, we present a genetic algorithm-based approach to automated design of complete auction mechanisms in the domain of CAT games. In a CAT game, multiple players, each providing his/her own design of a double-sided auction, compete against each other to attract traders for more profit and high transaction success rate. We show that this evolutionary method is effective in creating auction mechanisms in the CAT setting.

3 - Revenue Optimization and the Generalized Second-price Auction

David Thompson, PhD Student, University of British Columbia, 191-2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, davidrthompson@gmail.com

Search engines generate billions of dollars in advertising revenue using the generalized second-price auction (GSP). They have tried to further increase revenue using GSP variants including different kinds of reserve prices, and quality-score squashing. Our contributions are a comparison of different reserve price regimes (with and without squashing) and a study of how equilibrium selection affects the revenue generated by these variants.

4 - Profit-charging Market Makers with Bounded Loss, Vanishing Bid/Ask Spreads, and Unlimited Depth

Tuomas Sandholm, Carnegie Mellon University, Computer Science Dept., Pittsburgh PA , United State of America, sandholm@cs.cmu.edu, Abe Othman

It was an open question whether a market maker can simultaneously satisfy bounded loss, the ability to make a profit, a vanishing bid/ask spread, and unlimited market depth. We design market makers that do. We achieve this by introducing a practical framework that extends constant-utility cost functions with two functions that are added to the prices quoted to the trader: the liquidity function uses its proceeds to increase the liquidity, and the profit function is a "lockbox" of savings.

■ SC63

63- Borein B- Hyatt

Joint Session Behavioral/HAS: Antecedents and Consequences of Worker and Patient Behaviors in Health Care Settings

Sponsor: Behavioral Operations & Health Applications Society

Sponsored Session

Chair: Anita Tucker, Associate Professor and Marvin Bower Fellow, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu

Co-Chair: Reidar Hagtvedt, Assistant Professor of Management Science and Statistics, University of Alberta School of Business, 2-43 Business Building, Edmonton, AB, T6G2C7, Canada, reidar.hagtvedt@business.ualberta.ca

1 - Speaking Up About Internal Supply Chain Problems: Experiments on Medication Administration

Anita Tucker, Associate Professor and Marvin Bower Fellow, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02478, United States of America, atucker@hbs.edu

Employees who experience internal supply chain problems can provide valuable information about improvement opportunities. To understand the conditions under which employees are more likely to speak up about problems, we ran experiments using medication administration tasks for which we purposely created problems. Nurse spoke up under two conditions: (1) to obtain materials if there was no other way to work around the issue and (2) when their role identity was primed to include improvement.

2 - Desensitization to Stimuli and Optimal Expenditures to Increase Hand-hygiene in Hospitals

Reidar Hagtvedt, Assistant Professor of Management Science and Statistics, University of Alberta School of Business, 2-43 Business Building, Edmonton, AB, T6G2C7, Canada, reidar.hagtvedt@business.ualberta.ca, Sarah Forgie

Hand hygiene in hospitals is typically lower than recommended by the WHO. One strategy for change is to run educational campaigns, although empirical studies show health-care workers are aware of the importance of hand-hygiene. Such campaigns eventually recede into the background. We have purchased sensors for gel dispensers, in order to establish baseline usage and forgetting rates, which will then serve as input to a model to optimize resources used to increase hand-hygiene compliance.

3 - Multi-server Systems with Adaptive Server Behavior

Mohammad Delasay, Alberta School of Business, University of Alberta, Edmonton, AB, T6G2R6, Canada, delasays@ualberta.ca, Armann Ingolfsson, Bora Kolfal

We investigate service rates in the Calgary EMS system and show that service rates decrease with the number of busy ambulances. Then, we model and analyze systems in which service rates change with "load" (the number of busy servers) and "overwork" (the number of users served in the current full busy period). We demonstrate how ignoring adaptive server behavior results in inconsistencies between the planned and realized performance.

4 - Health Care Supply Chain for Behavioral Health: Evaluating Community Environment and Primary Care

David Zepeda, Assistant Professor, University of Minnesota, Minneaplis, MN, United States of America, zepe0003@umn.edu, Kingshuk K. Sinha

One in four people experience a behavioral health condition in their lifetime. Making treatment affordable and cost effective requires the integration of behavioral and physical care through primary care. Yet, the community environment can also influence behavioral health. Using clinic and community level data we evaluate the effects of the community environment (physical and social) and quality primary care (technology-enabled, evidence based, and affordable) on improving behavioral health.

■ SC66

66- Ellis West- Hyatt

Data Mining and OR in Health Application

Sponsor: Data Mining

Sponsored Session

Chair: Sung Won Han, Fellow, Hoffmann-La Roche Inc., 340 Kingsland St., Nutley, NJ, United States of America, sung_won.han@roche.com

1 - A Comparison of MCUSUM-based and MEWMA-based Surveillance Methods in Non-homogeneous Population

Sung Won Han, Fellow, Hoffmann-La Roche Inc., 340 Kingsland St., Nutley, NJ, United States of America, sung_won.han@roche.com

Motivated by applications in healthcare surveillance, we studied the spatiotemporal surveillance problem of detecting the mean change of Poisson count data in non-homogeneous populations. We investigate several likelihood ratio-based approaches and EWMA-based methods and compare them under various scenarios. We discuss under which scenarios the EWMA-based methods are more robust than the likelihood ratio-based approaches.

2 - Dynamic Spatiotemporal Warping for the Detection and Localization of Heart Attacks

Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

Myocardial infarction (MI), also known as heart attack, is the leading cause of death. This paper presents a novel warping approach to quantify the dissimilarity of disease-altered patterns in 3-lead VCG signals. The hypothesis testing shows there are significant space-time signal pattern variations between healthy controls (HC) and various MIs. The new approach yields an accuracy of 94.7% for separating MIs and HCs and an accuracy of 96.5% for anterior-related MIs and inferior-related MIs.

3 - Predicting Sequential Health Events

Benjamin Letham, Massachusetts Institute of Technology, Operations Research Center, Cambridge, MA, United States of America, bletham@mit.edu, David Madigan, Cynthia Rudin

Using a database of sequences of health events, we wish to learn a predictor that can use a patient's current medical history to predict future health events. We use ideas from supervised ranking to develop a framework for sequential predictions that allows for a variety of modeling choices. We apply our method to health event data from a clinical trial and demonstrate good performance.

4 - Contact Network Based Risk Assessment to Prevent Potential Pandemics

Shengpeng Jin, Teaching Asistant, University of Louisville, 782 Frederick Stamm Ct. Apt #4, 4, Louisville, KY, 40217, United States of America, jinshengpeng@gmail.com, Suraj Alexander

Early information is crucial for policy makers and public health officials. Current indicators of the spread of contagious outbreaks lag behind the actual spread of the epidemic, leaving no time for a planned response. Our focus, however, is on the effective control of the spread of contagious outbreaks in their early stages. In this paper, we use information from "central" individuals in "contact" networks for early "spatial - temporal" prediction of virulent contagious outbreaks.

■ SC67

67- Ellis East- Hyatt

Data Fusion for Manufacturing System Performance Improvement II

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Ran Jin, Assistant Professor, Virginia Tech., 1145 Perry St., Blacksburg, VA, 24060, United States of America, jran5@vt.edu

Co-Chair: Jian Liu, Assistant Professor, The University of Arizona, Rm 221 ENGR Building, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, jianliu@sie.arizona.edu

1 - Surface Variation Monitoring by Integrating Spatial Data with Cutting Force Models

Hui Wang, University of Michigan, Ann Arbor, MI, United States of America, huiwz@umich.edu

Variation control of surface shape becomes a key enabler of high-precision machining. This talk presents a method for efficiently measuring and monitoring variations of machined surfaces. Cutting force modeling is conducted and is correlated with surface spatial data to improve surface profile prediction. Using the prediction, a strategy under Bayesian framework is proposed to monitor surface variations without significantly increasing false alarms. A Ford case study demonstrates the method.

2 - The Use of Spatial Statistical Analysis for Image Based Part Inspection
Jaime Camelio, Associate Professor, Virginia Tech, 235 Durham Hall, Blacksburg, VA, United States of America, jcamelio@vt.edu, Lee Wells

Traditional quality control tools are based upon extracting features and measuring discrete dimensional data. However, new data-sets that are highly heterogeneous (multiple sensor types measuring different phenomena) and data-rich (thousands or even millions of data points). This presentation will use a case study of high-speed micro-scale part inspection using digital images and 3D laser scanning data. A cross-sensor spatial inspecting technique will be presented and its performance analyzed.

3 - Informative Sensor and Feature Selection via Hierarchical Non-Negative Garrote
Kamran Paynabar, University of Michigan, Ann Arbor, MI, United States of America, kamip@umich.edu

In order to effectively extract the information from a distributed sensing system, it is essential to develop a systematic method that not only can select important sensors/signals, but also can extract a low dimension of interpretable features from the high-dimensional vector of a selected signal. For this purpose, we develop a new hierarchical regularization approach called hierarchical non-negative garrote. Performance of the method is evaluated through simulations and a case study.

4 - Damage Identification for High-Speed Train Gearbox Shell Material Base on Acoustic Emission Technology
Weidong Zhang, University of Science & Technology Beijing, 30 Xueyuanroad, Haidian District, Beijing, 100083, China, zwd@ustb.edu.cn, Xiwen Zhang

The failure of high-speed train gearbox shell material is very important for the safety of high-speed train.In this paper,we use acoustic emission technology to monitor the the degree of damage in high-speed train gearbox shell material.The research work includes two main aspects: the data pre-processing method for imbalanced dataset and SVM modification method for imbalanced dataset. Then we apply these methods in the damage identification of high-speed train gearbox shell material.

5 - Engineering Driven Force Model Enhancement for the Laser Assisted Micro Milling (LAMM) Process
Chia-Jung Chang, Georgia Institute of Technology, 765 Ferst Drive, Main Building, Office 217, Atlanta, GA, 30332-0205, cchang43@gatech.edu, Mukund Kumar, Roshan Vengazhiyil, Shreyes N. Melkote

LAMM is capable of generating three dimensional microscale features in hard metals. An engineering-driven force model that captures the effect of thermal softening due to laser heating has been developed. We proposed a systematic way to estimate unknown model parameters with experimental force measurements. This model provides accurate force predictions over a range of production conditions in a timely manner which facilitates the LAMM process optimization to yield the maximal force reduction.

■ SC68

68- Suite 312- Hyatt

Finance: Theory and Empirics

Contributed Session

Chair: Yunchao Xu, National University of Singapore, Mochtar Riady Building, BIZ 1 8-69, 15 Kent Ridge Drive, Singapore, 119245, Singapore, bizxuy@nus.edu.sg

1 - Asset Price Bubbles in Experimental Markets
Vinod Cheriyan, Georgia Institute of Technology, 755 Ferst Drive NW, Atlanta, GA, 30332, United States of America, vinod.cheriyan@gatech.edu, Anton Kleywegt, Federico Bonetto

Asset price bubbles have been observed in experimental markets. However, in most of these studies the supply and demand of assets are specified exogenously. Also, their finite duration causes end of the horizon effects. In this work, we design an experimental market with endogenous supply and demand, and random duration. We show that asset price bubbles are possible in such markets. We present findings from our experiments. We also fit our model and other models of investor behavior to the data.

2 - How to Make Optimal Instruments for GMM More Efficient
Stephen Goldberger, University of North Carolina at Chapel Hill, Chapel Hill, NC, United States of America, sgoldber@live.unc.edu

For instrumental variables estimation of time series models with martingale difference sequence errors the optimal instruments are known but unobserved. We use mixed frequency data in order to create improved feasible optimal instruments, which in turn leads to more efficient parameter estimation.

3 - Minimum Quadratic Benchmark Regret in Portfolio Optimization
Yunchao Xu, National University of Singapore, Mochtar Riady Building, BIZ 1 8-69, 15 Kent Ridge Drive, Singapore, 119245, Singapore, bizxuy@nus.edu.sg, Zhichao Zheng, Chung Piaw Teo, Karthik Natarajan

We propose a minimum quadratic benchmark regret model to decide optimal portfolio weights, which combines flavor of traditional regret and tracking models. We provide closed-form expressions of the optimal portfolio weights, with or without consideration of transaction volumes, when the risky asset returns follow a multivariate normal distribution. Our portfolios demonstrate superior out-of-sample performance compared to numerous portfolio strategies studied in the literature.

■ SC69

69- Suite 314- Hyatt

Portfolio Management in Frictional Markets

Cluster: Optimization in Finance

Invited Session

Chair: Gerry Tsoukalas, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States of America, gtsouk@wharton.upenn.edu

Co-Chair: Dan Iancu, Assistant Professor, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States of America, daniancu@stanford.edu

1 - Fairness and Efficiency in Multiportfolio Optimization
Nikos Trichakis, Assistant Professor, Harvard Business School, Boston, MA, United States of America, ntrichakis@hbs.edu, Dan Iancu

When a manager is in charge of multiple accounts, the performance of each account depends on the strategies of others due to market impact. We propose a novel approach for jointly optimizing the trading activities of all accounts and also splitting the associated market impact costs. Our approach allows one to balance the conflicting objectives of maximizing aggregate gains and distributing them fairly. We perform numerical studies that suggest that our approach outperforms existing methods.

2 - Optimal Dynamic Portfolio Construction with Transaction Costs
John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu

Challenges for practical portfolio optimization include both time-varying return distributions and the presence of transaction costs. We consider simultaneous portfolio optimization and parameter estimation in a GARCH model with proportional transaction costs using consistent estimates of the opportunity cost of sub-optimal positions.

3 - Estimation Risk in Dynamic Portfolio Optimization
Alberto Martin-Utrera, Mr, University Carlos III of Madrid, C/ Madrid, 126-28903, GETAFE, Sp, 28903, amutrera@est-econ.uc3m.es, Francisco J. Nogales, Victor DeMiguel

We consider an investment decision problem for an investor whose objective function is to maximize her lifetime utility in the presence of trading costs. We study the effects of estimation error of the estimated optimal trading strategy within the investor's expected utility, and we propose several shrinkage methods to mitigate the effects of estimation error.

■ SC70

70- Suite 316- Hyatt

Theoretic Approach and Optimal Coordination Policies

Sponsor: Information Systems

Sponsored Session

Chair: Monica Johar, Assistant Professor, University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC, United States of America, msjohar@uncc.edu

1 - Optimal Information System Security Investment – A Control Theoretic Approach

Jing Zhou, Assistant Professor, University of North Carolina-Charlotte, 9201 University City Blvd, Friday 353C, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu, Xun Li, Monica Johar

Most of the IT security investment literature is based on single period analysis. In addition to the initial investment, a firm continues to exert effort to maintain the effectiveness of the IT infrastructure. We use a control theoretic framework to find the optimal IT security investment to minimize the expected total cost over a planning horizon. Our results can help firms decide how to invest in IT security given the type of the information system and the efficiency of the investment.

2 - Optimal Coordination Policies in Distributed Software Development

Vijay Mookerjee, University of Texas at Dallas, 800 W. Campbell Road, Richardson, TX, 75080, United States of America, vijaym@utdallas.edu

We study the problem of designing optimal coordination policies in distributed software development (DSD). Coordination in DSD can be both within one site and across different sites. The latter type coordination involves communication across spatial boundaries (different locations) and possibly temporal boundaries (different time zones) and is the main challenge that DSD faces. We consider both symmetric and aymmetric sites with randomness.

3 - Analyzing the Influence of Minimum Requirements on Coupon Selling in Groupon's Daily Deal

Gang Wang, University of Connecticut, 2100 Hillside Road, Storrs, CT, United States of America, gang.wang@business.uconn.edu, James Marsden, Xue Bai, Bill Ross

Minimum requirements have been one of the key features in Groupon's daily deal setting in which a certain number of coupons must be bought to activate the deal. Comparing two groups of Groupon deals, those with and those without minimum requirements, we isolate the influence of minimum requirements on social sharing, indicated by Facebook likes, and then analyze possible impacts on coupon sales and revenue for various retail categories.

■ SC71

71- Suite 318- Hyatt

Economics of Information Systems

Sponsor: eBusiness

Sponsored Session

Chair: Mingfeng Lin, University of Arizona, 1130 E. Helen St, Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu

1 - Optimal Choice for Market Price Information

Chris Parker, Pennsylvania State University, Smeal College of Business, University Park, PA, 16802, United States of America, chris.parker@psu.edu, Kamalini Ramdas, Nicos Savva

Information is only valuable if it is both new and actionable. We model a seller's selection of a market for which to purchase price information. We discuss the results of the model in the context of farmers in rural India and use data to analyze whether actual decisions are in line with our model.

2 - The Impact of IT on Economic Capacity

Dawei Zhang, University of Calgary, Haskayne School of Business, Calgary, Canada, dzhang@ucalgary.ca, Barrie Nault

We define economic capacity as the output level that maximizes short-run industry profit, and empirically explore the impact of IT on economic capacity and CU under a production function framework.

3 - Content Sharing in a Social Broadcasting Environment: Evidences from Twitter

Huaxia Rui, University of Texas at Austin, Austin, TX, United States of America, huaxia@utexas.edu

We collect a detailed dataset about the information-sharing activity on Twitter, called retweet, and estimate an econometric model regarding tie strength and retweeting behavior. The empirical results convincingly support our model and we find that after an author posts a median quality (as defined in the sample) tweet, the likelihood that a unidirectional follower will retweet is significantly higher than the likelihood that a bidirectional follower will.

4 - Geography in Online Peer-to-peer Lending

Mingfeng Lin, University of Arizona, 1130 E. Helen St., Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu, Siva Viswanathan

We study how geography affects investors' choice of loans to fund using data from Prosper.com, one of the largest online peer-to-peer lending websites. Using data from regular market conditions and from a natural experiment, we show that geography affects lender decisions, but this relationship is moderated by the nature of the loan request and the salience of geography in the marketplace.

■ SC72

72- Suite 322- Hyatt

Resource Management

Cluster: Cloud Computing

Invited Session

Chair: Natarajan Gautam, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, gautam@tamu.edu

1 - Efficient Management of Demand Loads in Cloud Computing Environments

Samyukta Sethuraman, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, samyukta@tamu.edu, Natarajan Gautam, Lewis Ntaimo

Energy efficiency can be achieved in cloud computing environments by cleverly assigning applications to servers, routing requests to appropriate servers, and speed-scaling of servers. We formulate and solve an optimization problem that minimizes expected energy consumption subject to satisfying QoS constraints. We develop a hybrid model that combines a deterministic optimization model and a stochastic fluid flow analysis in a unified manner.

2 - A Method to Generate Image for SPC by Point Cloud Data

Ketai He, Associate Professor, University of Science and Technology Beijing, No. 30, Xueyuan Rd., Haidian Dist., Beijing, 100083, China, ketaih@vt.edu, Jaime Camelio, Fadel Megahed

Image analysis is an important method of statistical process control in manufacturing. It is difficult to obtain suitable images for defect detection and analysis when products have irregular surfaces. Three-dimension surface scanner can get the surface information, but the data is difficult to analyze directly due to massive data points. We propose a method to generate image by point cloud data from surface scanner, which can be used in defect analysis.

3 - Optimal Arrival and Service Rate Control of Multi-server Queues with Application to Could Computing

Nelson Lee, Department of Statistics and Operations Research, University of North Carolina, Chapel Hill, NC, 27599, United States of America, leent@email.unc.edu, Vidyadhar Kulkarni

We consider the problem of optimal control of a multi-server queue with controllable arrival and service rates. This study is motivated by its potential application to the design and control of data centers or cloud computing facilities. The cost structure includes customer holding cost, server operating cost, and system operating reward. We derive structural properties of the optimal control policies under both discounted cost and average cost criterions.

■ SC73

73- Suite 324- Hyatt

Computational Finance I

Cluster: Quantitative Finance

Invited Session

Chair: Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, Hong Kong - PRC, nchen@se.cuhk.edu.hk

1 - Coco, Bail-in and Tail Risk

Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, Hong Kong-PRC, nchen@se.cuhk.edu.hk, Paul Glasserman, Behzad Nouri

We develop a capital structure model to analyze the incentives created by contingent convertibles (Cocos) and bail-in debt, two variants of debt that converts to equity as a bank nears or reaches financial distress. Our model combines endogeous default, debt rollover, and jump risks. We find that Cocos generally have positive incentive effects when the conversion trigger is not set too low.

2 - Optimal Deleveraging with Market Impact

Jingnan Chen, University of Illinois at Urbana-Champaign, Urbana, IL, 61801, United States of America, jchen98@illinois.edu, Jiming Peng, Liming Feng, Yinyu Ye

We consider an optimal liquidation problem where the objective is to meet specified leverage ratio at the minimal cost. Under linear price impact, the problem reduces to a generally non-convex quadratic program with quadratic and box constraints. We derive some analytical results regarding the optimal liquidation strategy. A Lagrangian method is proposed to solve the problem numerically.

3 - Consistent Pricing of Options on Leveraged ETFs

Martin Haugh, Columbia University IE&OR, 500 West 120th Street, Mudd 332, New York, NY, 10027, United States of America, mh2078@columbia.edu, Andrew Ahn, Ashish Jain

We consider the problem of pricing options on leveraged ETFs in a manner that is consistent with the pricing of options on the underlying security. The difficulty is that tractable underlying price dynamics do not in general translate into tractable LETF dynamics. We overcome this problem by approximating the LETF dynamics so that approximate LETF option prices can be computed very quickly via standard transform methods. We justify our approximations via Monte-Carlo experiments.

4 - Rare Event Simulation for Portfolio Default Losses

Xiaowei Zhang, HKUST, Hong Kong, Hong Kong-PRC, xiaoweiz@ust.hk

We use a self-exciting point process L(t) to model the default losses of a portfolio. Fixing the time horizon t, we develop an importance sampling (IS) simulation for estimating P(L(t)>x), i.e. the probability that the portfolio suffers a large default loss before time t. We will show that this IS scheme achieves a significant variance reduction compared to plain Monte Carlo simulation.

Sunday, 4:30pm - 6:00pm

■ SD01

01- West 101- CC

Joint Session Opt-Global/ENRE-Energy: Global Optimization in Energy

Sponsor: Optimization/Global Optimization & Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Steffen Rebennack, Assistant Professor of Operations Research, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, srebenna@mines.edu

Co-Chair: Timo Lohmann, PhD Student, Colorado School of Mines, 816 15th Street, Golden, CO, 80401, United States of America, tlohmann@mines.edu

1 - Decomposition Strategies for Stochastic Mixed-integer Nonlinear Programs with Energy Applications

Paul I. Barton, Lammot du Pont Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 66-464, Cambridge, MA, 02139, United States of America, pib@mit.edu

We present a recently developed deterministic global optimization approach with running time that scales linearly with the number of scenarios considered. This enables the solution of large-scale instances of problems that arise in the optimization of a variety of energy systems under uncertainty, such as the planning of natural gas production infrastructure, the design of flexible energy polygeneration systems, feedstock selection for oil refineries, etc.

2 - The Optimal Power Flow Problem Model as a MILP (Mixed-Integer Linear Programming)

Maria de Luján Latorre, Researcher, PSR, Praia de Botafogo 228/1701-A Botafogo, Rio de Janeiro, RJ, 22250-145, Brazil, lujan@psr-inc.com, Sérgio Granville, Mario Veiga Pereira, Rafael Ferreira, André Dias

The OPF problem determines the optimal operation of generation and transmission system representing the AC network constraints in an integrated form. In this work we apply McCormick inequalities and disjunctive constraints to linearize the original nonlinear and non-convex optimization problem. Mixed Integer Programming models are derivate both in Polar as in Cartesian coordinates systems. Results compare both formulations with the original OPF model.

3 - Global and Local Approaches for Large-scale Security-constrained Optimal Power Flow

Dzung Phan, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, phandu@us.ibm.com, Jayant Kalagnanam

We present global and local methods for solving the security-constrained optimal power flow problem. We propose a class of global methods based on Lagrangian duality to solve the problem to optimality. For practical uses when dealing large-scale instances, two decomposition algorithms based on Benders cut and ADMM are investigated. These schemes often generate solutions whose objective values are smaller than the conventional approach and are very close to the optimal points.

4 - Optimization of Electrical Efficiency using Mixed AC/DC Distribution

Stephen Frank, PhD Student, Electrical Engineering, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, stfrank@mymail.mines.edu, Steffen Rebennack, Pankaj (PK) Sen

The majority of electrical loads and distributed generation sources in modern buildings require direct current (DC), but grid-level electricity generation, transmission, and distribution systems continue to use alternating current (AC). A significant amount of energy is lost due to AC/DC conversion. This presentation explores formulations and solution methods for the optimal design of mixed AC/DC distribution systems to minimize the losses due to AC/DC conversion.

■ SD02

02- West 102 A- CC

2012 DAS Practice Award Presentations

Sponsor: Decision Analysis

Sponsored Session

Chair: Gregory Parnell, United States Military Academy, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu

1 - Catalyze Supports UK Ministry of Defence Training Rationalisation

Carmen Carmona, Consultant, Catalyze, 1 The Old Diary, Bunstead Barns, Hursley, SO21 2LL, United Kingdom, CarmenCarmona@catalyze.co.uk, Patrick Warburton, Rex Mazonowicz

Catalyze designed and implement a two level stakeholder socio-technical process aiming to consistently assess 24 possible options, using a mix of financial, socio and technical criteria. The process allowed the wider stakeholders and MOD scrutiny community to be convinced of the integrity of the decision consequences and engage MOD Experts from all three armed services. (Navy, Royal Air Force and Army)

2 - AESA: Decision Analysis in Search for Safer Skies

David Rios Insua, Professor on Statistics and Decision Sciences, Royal Academy of Sciences, Calle Valverde, 22, Madrid, Spain, david.rios@urjc.es, Pablo Hernandez-Coronado, Esperanza Herraiz, Jorge Valero, Veronica Elvira

We describe the pioneering efforts of the Spanish Agency for Air Transportation Safety in using Decision Analysis within the State Safety Programme. We illustrate modeling issues in forecasting threats and their severities, identifying and communicating the most severe ones, allocating resources to mitigating them, and delivering safe sky policies in public-private partnership.

3 - Operations Analysis Workforce Development Capabilities Assessment

William Nanry, Member, Group Technical Staff, Lockheed Martin Missiles and Fire Control, 1701 W. Marshall Drive, Grand Prairie, TX, 75265, United States of America, william.nanry@lmco.com, Steve Dininger

To enhance operations analysis (OA), the Lockheed Martin OA Workforce Development Team assessed the value each OA capability / skill provides to anticipate needs, assess shortfalls, and articulate mission understanding to generate affordable and relevant solutions for decision-makers and end-users. A multi-attribute decision support exercise was conducted to identify those key critical OA capabilities / skills across Lockheed Martin.

■ SD03

03- West 102 B- CC

Joint Session DAS/HAS: Decision Analytic Models in Healthcare

Sponsor: Decision Analysis & Health Applications Society

Sponsored Session

Chair: Turgay Ayer, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, ayer@isye.gatech.edu

1 - Monotone Policies in Dynamic Medical Treatment Planning

Archis Ghate, University of Washington, Industrial and Systems Engineering, Seattle, WA, United States of America, archis@uw.edu

A central problem in medicine requires physicians to choose dose levels that achieve adequate disease control while limiting adverse effects over a treatment course with multiple decision points. We propose a stylized stochastic dynamic programming formulation of this problem and prove the existence of a monotone optimal policy in which dose levels increase with disease severity. This result is illustrated using an example from cancer radiotherapy.

2 - Optimizing Radiation Delivery Schedules for Gliomas

Kevin Leder, Assistant Professor, University of Minnesota, 111 Church St., Minneapolis, MN, 55455, United States of America, Kevin.Leder@me.umn.edu, Ken Pitter, Eric Holland, Franziska Michor

We construct a model to study the response of gliomas to radiation therapy. In particular, we consider a model considering two distinct cell populations, a slow growing radio-resistant stem cell population and a faster growing radio-sensitive progenitor cell population. Cells dynamically switch back and forth between these two states in response to radiation doses. In the context of this model we identify near optimal dosing schedules, and compare their performance to standard therapies.

3 - Evaluating the Impact of Performance Goals on Emergency Medical Service Dispatching Decisions

Laura McLay, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave., Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Maria Mayorga

Emergency medical services measure performance based on response time thresholds, i.e., the proportion of calls responded to within a fixed timeframe. The ultimate goal of emergency medical services is to save lives, which suggests that it might be worthwhile to consider using performance measures more closely tied to patient outcomes. This paper examines how different response time threshold performance goals impact patient survival rates in the context of emergency medical dispatch.

4 - Improving Access to Community-based Chronic Care through Improved Capacity Allocation

Tingting Jiang, Student, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, tingting-jiang@northwestern.edu, Seyed Iravani, Sarang Deo, Karen Smilowitz

We study a model of community-based healthcare for chronic diseases. Patients periodically access the healthcare system, influencing their disease progression and health outcomes. The provider's goal is to maximize community-wide health outcomes, subject to capacity constraint. We investigate how the provider can improve her objective through better operational decisions.

■ SD04

04- West 102 C- CC

Scoring Rules, Probability Assessment, and Bias

Sponsor: Decision Analysis

Sponsored Session

Chair: Robert Hammond, The University of Texas at Austin, 1 University Station, Austin, TX, United States of America, robertkh@gmail.com

Co-Chair: Eric Bickel, Assistant Professor, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, United States of America, ebickel@mail.utexas.edu

1 - Lossed in Translation: Adjusted Scoring Rules to Recover Subjective Beliefs from Loss-Averse Experts

Asa Palley, The Fuqua School of Business, Duke University, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, abp12@duke.edu, Theo Offerman

We apply a prospect theory model of risk preferences to examine the incentives of an expert under an asymmetric quadratic scoring rule. We use these results to develop the L-adjusted scoring rule, a modified quadratic rule that corrects these distortions and allows for the recovery of an accurate estimate of probabilistic beliefs. Finally, we conduct an experiment that demonstrates the effectiveness of this modification in eliciting truthful beliefs and eliminating conservative baseline reports.

2 - Gender and Performance in Risky Situations

Susan Fisk, PhD Candidate, Stanford University, Sociology Deparment, Building 120, Room 031, Stanford, CA, 94305, United States of America, sfisk@stanford.edu, Ross Shachter

We explore the role gender plays in risk-taking, using data from a large undergraduate decision analysis class in which the midterm uses a probabilistic scoring rule but the final exam does not. Controlling for academic major, we find that women take fewer risks than men, confirming established research on gender and risk-taking. In addition, we find that women perform worse on exams when their grade is determined by the scoring rule instead of conventional grading methods.

3 - Strictly Proper Mechanisms with Cooperating Players

Ross Shachter, Associate Professor, Stanford University, Department of Management Science and Eng, Huang Engineering Center, Stanford, CA, 94305, United States of America, shachter@stanford.edu, SangIn Chun

Prediction markets provide an efficient means to assess uncertain quantities from forecasters. Although traditional and competitive strictly proper scoring rules have been shown to incentivize forecasters to provide accurate probabilistic forecasts acting alone, when forecasters with different beliefs can cooperate, these mechanisms instead discourage honest reports. Nonetheless, we show conditions under which the decision maker can confidently apply the assessed probabilities.

4 - Scoring Rules and the Measurement of Uncertainty

Eric Bickel, Assistant Professor, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, United States of America, ebickel@mail.utexas.edu

Strictly proper scoring rules (SPSRs) continue to play an important role in probability assessment. While many such rules have been developed, relatively little guidance exists as to which rule is the most appropriate. All SPSRs reward calibration. In this presentation, we focus on how differing rules reward sharpness and argue that log scoring is the only rule that is consistent with entropy as a measure of uncertainty.

■ SD05

05- West 103 A- CC

Process Engineering

Contributed Session

Chair: Raed Naebulharam, Research Assistant, University of Wisconsin-Milwaukee, 3200 North Cramer St, EMS 280, Milwaukee, WI, 53211, United States of America, naebulh2@uwm.edu

1 - Refinery Operation Decisions with the Consideration of the Price Fluctuations

Ruoran Chen, PhD Student, Department of Industrial Engineering, Tsinghua University, Building ZJ14#0429A, Beijing, 100084, China, crr11@mails.tsinghua.edu.cn, Simin Huang, Ruwen Qin

Refineries face the price fluctuations in crude oil and products when making decisions in procurement and production. We first construct an LP model for a refinery to maximize the total profit. Then the model is extended to a large-scale multi-period stochastic dynamic programming to optimize the procurement, inventory and refinery decisions. A numerical method is developed to solve the problem. Numerical experiments are set up to demonstrate the importance of integrating these decisions.

2 - Integrated Maintenance and Production Scheduling under Deteriorating Machine Conditions

Maliheh Aramon Bajestani, PhD Candidate, University of Toronto, Mechanical & Industrial Engineering Dept, Unit 804, 141 Davisville Ave., Toronto, ON, M4S 1G7, Canada, maramon@mie.utoronto.ca, J. Christopher Beck, Dragan Banjevic

We address the problem of maintenance and production scheduling in a deteriorating multi-stage, multi-product system with random demand. Exploiting machine condition information, we formulate a Markov decision process model to determine the maintenance plan over the long term and then formulate an integer programming model to find the maintenance and the production schedule in the current period. Our results demonstrate that the planned schedule is very close to the actual schedule that is executed.

3 - Hub and Chain: A Variance-based Method for Designing Process Flexibility

Zhiguang Han, PhD Student, Nanyang Business School, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798, Singapore, hanz0007@ntu.edu.sg, Shaoxiang Chen, Geoffrey Chua

We study the process flexibility design issue. To our best knowledge, the demand variance has been generally ignored in the literature. We investigate the effect of demand variance and present a simple variance-based method to construct good flexible structures that link several small chains together in a hub. Our numerical tests show that our method performs better than existing methods such as chaining and constraint sampling, in both computational time and structure quality.

4 - Bernoulli Serial Lines with Deteriorating Product Quality: Evaluation & System-theoretic Properties

Raed Naebulharam, Research Assistant, University of Wisconsin-Milwaukee, 3200 North Cramer St., EMS 280, Milwaukee, WI, 53211, United States of America, naebulh2@uwm.edu, Liang Zhang

This paper assumes that the probability that each unfinished part is of good quality is a decreasing function of its residence time in the preceding buffer. Then, in serial production lines with machines having Bernoulli reliability model, closed-form formulas for performance evaluation in the two-machine line case were derived, and an aggregation-based procedure to approximate the performance measures in M > 2-machine lines was developed. Monotonicity properties were also studied.

5 - Demand Forecasting in Revenue Management under Availability Constraints

Shadi Sharif Azadeh, Polytechnique Montreal, 2900 Boulevard Edouard-Montpetit Montre, Montreal, QC, Canada, shadi.sharifazadeh@polymtl.ca, Gilles Savard

We investigate the problem of demand forecasting in transportation. Seats are limited therefore, transportation companies continue to accept reservations in a fare class until the booking limit is reached. We propose an optimization model which takes availability constraints into account in order to have more accurate insight about demand behavior.

■ SD06

06- West 103 B- CC

Metamodeling Techniques for Simulation Optimization

Sponsor: Simulation

Sponsored Session

Chair: Sujin Kim, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, 117576, Singapore, iseks@nus.edu.sg

1 - A New Framework for Combining Global and Local Surrogates in Black-box Optimization

Yibo Ji, National University of Singapore, Kent Ridge Crescent, Singapore, 119260 SK, Singapore, jiyibo@nus.edu.sg, Wendy Xu, Myun-Seok Cheon, Sujin Kim

We propose a new framework for solving computationally expensive optimization problems, where neither their closed-forms nor derivatives are available. We first build a global metamodel to identify the promising area, and then conduct a local search to ensure local optimality. One of the key performance factors is how we balance the two procedures. The framework is designed to accommodate various types of global and local search methods. Numerical studies demonstrate the feasibility of our work.

2 - Enhancing Stochastic Kriging Metamodels with Gradient Estimators

Barry Nelson, Professor, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208-311, United States of America, nelsonb@northwestern.edu, Xi Chen, Bruce Ankenman

Stochastic kriging is a metamodeling technique for effectively representing the mean response surface implied by a stochastic simulation. We show that incorporating gradient estimates into stochastic kriging tends to significantly improve surface prediction. We also evaluate the properties of infinitesimal perturbation analysis and likelihood ratio gradient estimators when incorporated into stochastic kriging.

3 - Augmenting Simulation Metamodels with Direct Gradient Estimates

Huashuai Qu, University of Maryland, College Park, MD, United States of America, huashuai@math.umd.edu, Michael Fu

Traditional metamodel-based optimization methods assume experiment data collected consist of performance measurements only. However, in many settings found in stochastic simulation, direct gradient estimates are available. We investigate techniques that augment existing regression and stochastic kriging models to incorporate additional gradient information. The augmented models are shown to be compelling compared to existing models, in the sense of improved accuracy or reducing simulation cost.

■ SD07

07- West 104 A- CC

Machine Learning I

Sponsor: Data Mining

Sponsored Session

Chair: Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu

1 - Using Latent Semantic Analysis and Support Vector Machine in Multi-level Polarity Sentiment Analysis

Yilu Zhou, Assistant Professor, George Washington University, 2201 G St NW Suite 515, Washington, DC, 20052, United States of America, yzhou@gwu.edu

We propose a multi-level polarity sentiment analysis framework that utilizes a Natural Language Processing technique: Latent Semantic Analysis (LSA) to reduce feature dimensionality and a multi-classifier SVM to detect sentiment level. We conducted a series of experiments to estimate the optimal kernel parameters and the dimension of features. The results shows that LSA can effectively reduce term feature dimensions and the optimal dimension and kernel parameters can boost the performance.

2 - Machine Learning Methods from Statistical Physics

Mohsen Bayati, Stanford University, Stanford, CA, United States of America, bayati@stanford.edu, Andrea Montanari

We present results on approximate message passing (AMP) that is an iterative algorithm for high-dimensional data analysis and is inspired by statistical physics ideas.

3 - A Comparison of Criteria for the Smoothing Parameter Selection in Partial Spline with Change Points

Sung Won Han, Fellow, Hoffmann-La Roche Inc., 340 Kingsland St., Nutley, NJ, United States of America, sung_won.han@roche.com, Hua Zhong

In many applications such as bio-informatics, the estimation of the starting and ending points of drop-down in the longitudinal data is one of the key problems. We used a partial spline model based on the reproducing kernel Hilbert space-based spline and multiple change points. Since the existing criteria for the smoothing parameter selection in partial spline with change points are not proper, we propose simple and better criteria to estimate change points.

■ SD08

08- West 104 B- CC

Joint Session SPPSN/MAS: Humanitarian Logistics and Disaster Response I

Sponsor: Public Programs, Service and Needs & Military Applications

Sponsored Session

Chair: Jarrod Goentzel, Massachusetts Institute of Technology, Room E38-650, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, goentzel@mit.edu

1 - Airport Congestion During Relief Operations

Mike Veatch, Gordon College, Department of Mathematics, 255 Grapevine Rd, Wenham, MA, 01984, United States of America, Mike.Veatch@gordon.edu, Jarrod Goentzel

Scheduling the airlift of relief supplies into a damaged or small airport during a crisis is a major challenge. Adapting to the local conditions and coordinating the many international donors and airlift providers is complex. Alternative scheduling methods are proposed and assessed using queueing models with data from the Haiti earthquake.

2 - Managing Bottlenecks in Port and Overland Transport Networks for Food Aid

Mallory Soldner, Georgia Institute of Technology, Atlanta, GA, United States of America, msoldner@gatech.edu, Jarrod Goentzel, Ozlem Ergun

Based on experience with WFP in East Africa, port bottlenecks can restrict the flow of life saving food aid. We introduce a canonical framework for building acyclic queuing networks to model port and overland transportation networks. Steady state equations and approximations are used to define cost and time bottlenecks. We classify how these bottlenecks shift in the network depending on parameters and decisions. Finally, we consider how adding capacity to the network impacts efficiency.

3 - Modeling and Analyzing Supply Chain Viability

Mariah Magagnotti, Graduate Research Assistant, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States of America, mariahm@clemson.edu, Scott Mason

The supply chain literature reveals many performance measures focused on localized costs and/or throughput. A holistic view is more appropriate when a supply chain is disrupted due to an emergency or disaster, as many of the key decisions to be made are interdependent. We present a capacitated, multi-commodity flow model under two competing objectives and demonstrate how viability-based decision making can impact both performance measures of interest.

4 - Scheduling and Routing for a Bus-based Evacuation with Constant Evacuee Arrival Rate

Victor Pereira, PhD Student, Virginia Tech, Department of Industrial and Systems Eng., 250 Durham Hall, Blacksburg, VA, 24061-0118, United States of America, vpereira@vt.edu, Douglas Bish

In this presentation, a variant of the vehicle routing problem for bus-based evacuation planning is introduced. The problem assumes that evacuees arrive at a constant rate, and seeks a schedule of pick-ups and the routes for a fleet of buses that minimizes their waiting time at various pick-up locations. In addition, the effect of service level over the waiting time is explored and upper and lower bounds on the fleet size and an upper bound on the number of arc traversals per bus are proposed.

■ SD09

09- West 105 A- CC

AHP/ANP Applications

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Birsen Karpak, Professor of Management, Youngstown State University, One University Plaza, WCBA 3303, Youngstown, OH, 44555, United States of America, bkarpak@ysu.edu

1 - Integrating Multicriteria Analysis and Geographic Information Systems: An Application of Spatial ANP

Valentina Ferretti, PhD, Politecnico di Torino, Corso Castelfidardo 30/A, Torino, 10138, Italy, valentina.ferretti@polito.it, Giulio Mondini

Spatial Multicriteria Evaluations are rapidly gaining traction for planning and policy-making as useful tools to make decision processes effective and reliable. The contribution proposes a Spatial Multicriteria approach based on the integration of Geographic Information Systems and the Analytic Network Process for the development of a land suitability analysis in the context of undesirable facilities location problems. The integrated approach is able to cope with complex decision problems.

2 - Evaluating the Performance of Brazilian Financial Managers with the AHP

Luiz F. Autran M. Gomes, Professor, Ibmec/RJ, Av. Presidente Wilson, 118, Room 1110, Rio de Janeiro, 20030020, Brazil, autran@ibmecrj.br, Renata Andrade

The key objective of this paper is to show, through a case study, how managers working for a financial organization in Brazil were evaluated in their performance by using the AHP method. Based on the success of the study the organization has decided that the AHP method should definitely be considered as the analytical tool to be utilized in their future performance evaluation processes.

3 - Evaluation of Emergency Distribution Centers in Istanbul

Ozay Ozaydin, Research Assistant, Dogus University, Zeamet S. No:21, Acibadem, Istanbul, 34722, Turkey, oozaydin@dogus.edu.tr, Ilker Topcu

In disaster management, logistics play a major role and distribution centers are namely in the center of this role. As Istanbul has a highly dynamic environment, the previous studies on location of distribution centers can rapidly become obsolete and even infeasable. Using Geographical Information Systems (GIS) as main data input for an AHP model, this study not only evaluates the current situation but also proposes a dynamic system to make additional research and update process more manageable.

4 - Cloud Computing Vendor Selection for the City of Pittsburgh

Enrique Mu, MBA Program Director, Carlow University, 3333 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, ENRIQUEM@pitt.edu, Howard Stern

Like many government agencies, the technology department at the City of Pittsburgh has had to deal with shrinking budgets and increased demands for state-of-the-art technology like cloud computing. The City employed the Analytic Hierarchy Process (AHP) methodology to select the most innovative and cost-effective cloud computing solution provider. Lessons learned and issues with respect to this collaboration and public group decision-making in the context of new technology will be discussed.

■ SD10

10- West 105 B- CC

Stochastic Programming with Discrete Random Variables

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Anh Ninh, Rutgers Center of Operations Research, Rutgers University, Piscataway, United States of America, ninhtuananh@gmail.com

1 - Probabilistic Constrained Stochastic Programming with Independent Discrete Random Variables

Kunikazu Yoda, PhD Candidate, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854-8003, United States of America, kyoda@rutcor.rutgers.edu, Andras Prekopa

We consider the probabilistic constrained stochastic programming problem where the random right-hand side vector of independent components follows a discrete distribution with a finite support. The decision variables can be integers or real numbers. The problem is formulated by a mixed-integer linear programming with the concept of p-efficient points of a distribution. We present some techniques to improve the performance of the solution with MILP solver software and show numerical examples.

2 - Numerical Solution of Large Scale Moment Problem in Case of Piecewise Higher Order Convex Objective

Anh Ninh, Rutgers Center of Operations Research, Rutgers University, Piscataway, United States of America, ninhtuananh@gmail.com, Gabriela Alexe, Andras Prekopa

We propose efficient numerical solution for the (continuous) power moment problem where the objective function is piecewise higher order convex. The solution goes through the solution of discrete moment problems with Vandermonde matrices in the equality constraints. Problems with up to 30 moments can efficiently be solved but we can go higher in special cases. Numerical results will be reported.

3 - Solution of the Univariate Discrete Moment Problem for New Classes of Functions

Mariya Naumova, RUTCOR, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, mnaumova@rci.rutgers.edu

We characterize the dual feasible bases, in connection with univariate discrete moment problem for classes of objective function not dealt with until now. The new classes include, e.g., step functions with finite number of values. Applications will be mentioned to engineering design and finance.

■ SD11

11- West 105 C- CC

Models in Robust Optimization

Contributed Session

Chair: Andreas Thorsen, PhD Candidate, Industrial Engineering and Operations Research, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, aht105@psu.edu

1 - Robust Optimization and Uncertain Prices in an Oil Refinery Supply Chain

Jens Bengtsson, School of Economics and Business, Norwegian University of Life Sciences, P.O. Box 5003, Aas, Norway, jens.bengtsson@umb.no, Patrik Flisberg, Mikael Ronnqvist

Uncertain prices of crude oil and refinery products may seriously affect the profitability of the refinery value chain. In this project we analyze the oil refinery planning problem using robust optimization in order to handle uncertainties in prices and to determine robust plans. The uncertainties can be described using historical and/or forecasted data in a flexible model.

2 - Distributionally Robust Convex Optimization

Wolfram Wiesemann, Imperial College London, 180 Queen's Gate, London, United Kingdom, wwiesema@imperial.ac.uk, Melvyn Sim, Daniel Kuhn

Distributionally robust optimization studies stochastic programs whose uncertain parameters follow a distribution that is itself uncertain. The distribution is only known to belong to an ambiguity set defined in terms of statistical or structural properties, and the goal is to hedge against the worst-case distribution within the ambiguity set. In this talk we present several distributionally robust optimization problems that admit polynomial-time solvable reformulations or approximations.

3 - The Robust Model for City Logistic Terminal Location

Afrooz Ansaripour, University of Oklahoma, School of Industrial Engineering, Norman, OK, 73072, United States of America, afrooz.ansaripour@ou.edu, Theodore Trafalis, Mostafa Badakhshian

The concept of logistic terminals has been presented to help cities reduce the total number of urban trips and negative impacts of transportation. This paper aims to apply robust optimization in the city logistic terminal location problem. The main goal is to minimize the transportation volume between the terminals considering uncertainty. The indicators include the flow and distances between terminals and also the weight of each flow. Preliminary computational results will be presented.

4 - Robust Optimization Models for Military Airlift under Demand Uncertainty

Andreas Thorsen, PhD Candidate Industrial Engineering and Operations Research, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, aht105@psu.edu, Tao Yao

The military airlift problem involves allocating cargo and passenger demands to aircraft and determining routes in order to achieve cost goals such as reducing overall cost and fuel consumption. Using robust optimization, we study the robust military airlift problem under demand uncertainty and present several mixed-integer program formulations including (static RO, two-stage RO, and multi-stage RO). We present results using data from the US military and examine the cost/robustness tradeoffs.

5 - Estimating the Violation of the KKT Conditions

Delphine Mico-Umutesi, University of Florida, 358 Little Hall, Gainesville, FL, 32611, United States of America, delmico@ufl.edu, William Hager

Given x, not necessarily a local minimizer of an optimization problem, we propose a quantitative way of estimating how close x is to a solution of the KKT conditions. This estimate of the distance to a KKT point is the solution of a non-convex optimization problem. We show how to solve this problem using an Active Set Algorithm (ASA) .

■ SD12

12- West 106 A- CC

Advances in Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: James Ostrowski, University of Tennessee, 1425 S Stadium Dr, Knoxville, TN, 37996, United States of America, jostrows@utk.edu

1 - On Linear Programming Formulations of the TSP Polytope

Sebastian Pokutta, Friedrich-Alexander-Universitat Erlangen-Nürnberg, Cauerstrasse 11, Erlangen, 91058, Germany, sebastian.pokutta@me.com, Serge Massar, Hans Raj Tiwary, Ronald de Wolf, Samuel Fiorini

We solve a 20-year old problem posed by M. Yannakakis and prove that there exists no polynomial-size linear program (LP) whose associated polytope projects to the traveling salesman polytope, even if the LP is not required to be symmetric. Moreover, we prove that this holds also for the maximum cut problem and the stable set problem. These results follow from a new connection that we make between one-way quantum communication protocols and semidefinite programming reformulations of LPs.

2 - Solution Approaches for the Cutting Stock Problem with Setup Cost

Ali Ekici, University of Houston, Department of Industrial Engineering, Houston, TX, United States of America, aekici@central.uh.edu, Azadeh Mobasher

In this research, we study the Cutting Stock Problem with Setup Cost (CSP-S). In CSP-S, unlike traditional Cutting Stock Problem (CSP), we have separate cost factors for the number of setups and material usage, and the objective is to minimize total production cost including both material and setup costs while satisfying demand. We propose two local search algorithms and a column generation algorithm, and test these algorithms on a set of instances from the literature.

3 - Partial Objective Function Inequalities for the Multi-Item Capacitated Lot-Sizing Problem (MCLSP)

Esra Buyuktahtakin, Assistant Professor, Wichita State University, IME Department, Wichita, KS, United States of America, esra.b@wichita.edu, J. Cole Smith, Joseph Hartman

We derive valid bounds on the partial objective function of the MCLSP formulation via dynamic programming and integer programming techniques. We then develop algorithms for strengthening these valid inequalities by back-lifting binary and continuous variables. These inequalities are utilized in a cutting-plane strategy, in which we perturb the partial objective function coefficients for the MCLSP polytope. We present computational experiments with the proposed valid inequalities.

4 - Optimizing the Layout of Proportional Symbol Maps

Tallys Yunes, Department of Management Science, University of Miami, Coral Gables, FL, 33124-8237, United States of America, tallys@bus.miami.edu, Guilherme Kunigami, Pedro de Rezende, Cid de Souza

Proportional symbol maps help cartographers and geo-scientists visualize geo-positioned data, e.g. population and earthquakes. At specific locations, symbols are placed and scaled to make their areas proportional to the magnitude of the data. We present a novel IP model to draw opaque disks on a map while maximizing the visible border of all disks. We implement new decompositions and facets in a branch-and-cut algorithm, and are the first to optimally solve real instances of this problem.

■ SD13

13- West 106 B- CC

Efficient Optimization Algorithms and Their Recent Applications

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Hongchao Zhang, Louisiana State Univeristy, Department of Mathematics, Baton Rouge, United States of America, hozhang@math.lsu.edu

1 - Minimizing Rational Functions by Exact Jacobian SDP Relaxation

Li Wang, University of Southern California, 3715 McClintock Ave., RM 236, Los Angeles, CA, 90089, United States of America, Wang40@usc.edu, Feng Guo

We study the optimization problem of minimizing a rational function. We reformulate this problem as polynomial optimization by the technique of homogenization. These two problems are shown to be equivalent under some general conditions. The exact Jacobian SDP relaxation method proposed by Nie is used to solve the resulting polynomial optimization.

2 - Mini-batch Stochastic Approximation Methods for Constrained Nonconvex Stochastic Programming

Saeed Ghadimi, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, sghadimi@ufl.edu, Hongchao Zhang, Guanghui Lan

We present a randomized mini-batch stochastic approximation method for solving constrained nonconvex stochastic programming problems. Complexity analysis of finding an approximate stationary point of this kind of problems is provided. Some computational results are also presented to show practical performance of the proposed algorithm.

3 - A Quadratic C0 Interior Penalty Method for the Displacement Obstacle Problem of Clamped Plates

Yi Zhang, Graduate Student, Louisiana State University, 103 Lockett Hall, Department of Mathematics, LSU, Baton Rouge, LA, 70803, United States of America, yzhang24@math.lsu.edu, Li-yeng Sung, Hongchao Zhang, Susanne Brenner

The displacement obstacle problem of clamped Kirchhoff plates is an example of a fourth order variational inequality whose numerical analysis is more subtle than that of second order variational inequalities. In this talk we will introduce C0 interior penalty methods for this problem. Both error estimates and numerical results will be discussed. This is joint work with Susanne Brenner, Li-yeng Sung and Hongchao Zhang.

■ SD14

14- West 106 C- CC

United States Presidential Election Forecasting: Who Will Win the White House in 2012?

Cluster: Public Policy

Invited Session

Chair: Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue (MC258), Urbana, IL, 61801, United States of America, shj@illinois.edu

1 - The Keys to the White House: Forecast for 2012

Allan Lichtman, Distinguished Professor, Department of History, American University, Washington, DC, 20817, United States of America, lichtman@american.edu

This paper will present the Keys to the White House and provide a forecast for the 2012 presidential election. The Keys to the White House are a historically-based prediction system that retrospectively account for the popular-vote winners of every American presidential election from 1860 to 1980 and prospectively forecast well ahead of time the popular-vote winners of every presidential election from 1984 through 2012.

2 - Modeling a Presidential Prediction Market

Keith Chen, Yale School of Management, New Haven, CT, United States of America, Keith.chen@yale.edu, Edward Kaplan

Using data from past Intrade US presidential prediction markets, we examined three alternative models for security prices, focusing on consistency with electoral college rules. We show that a simple diffusion model provides a good description of the overall distribution of electoral college votes, while an even simpler ranking model provides excellent predictions of the probability of winning the presidency. We derive implications for predicting the 2012 US presidential election.

3 - The 2012 United States Presidential Election: And the Winner is?

Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue (MC258), Urbana, IL, 61801, United States of America, shj@illinois.edu, Edward Sewell, Steve Rigdon, Jason Sauppe

Predict the number of electoral college votes for each candidatein the United States Presidential election can be a difficult task. This presentation discusses a Bayesian approach incorporating undecided voter effects into the analysis. A web site electionanalytics.cs.illinois.edu has been created for people to follow the resulting forecasts.

■ SD15

15- West 202- CC

Software Demonstration

Invited Session

1 - Lumina Decision Systems, Inc. - Introduction to Analytica, What it Does that Spreadsheets Can't

Surya Swamy, Consulting Decision Analyst, Lumina Decision Systems, 26010 Highland Way, Los Gatos, CA, 94117, United States of America, surya@lumina.com

Experienced analysts prefer Analytica to spreadsheets because of its visual influence diagrams, Intelligent Arrays, fast Monte Carlo and scalability. Because it's designed by expert modelers, it's also an ideal tool for teaching students the art of effective modeling. View this software demo to see why users say that they can build, verify and analyze models in a quarter to half the time it takes with a spreadsheet.

2 - Exploiting LINKS Simulations Web-based Resources for Maximum Teaching and Learning Impact

Randall G. Chapman, Founder and President, LINKS Simulations, 320 Forest Haven Drive, Winter Garden, FL, 34787, United States of America, chapman@LINKS-simulations.com

How can an instructor teach effectively and efficiently with a large-scale, team-based, competitive supply chain management simulation? By exploiting the simulation's web-based teaching and learning resources! This software demo explores web-based resources for supporting instructors and their students throughout LINKS simulation events.

■ SD16

16- West 207- CC

Application of Kalman Filter in Traffic Management and Control

Cluster: Tutorials

Invited Session

Chair: Hans van Lint, Associate Professor, Delft University of Technology, Stevinweg 1, Delft, 2628CN, Netherlands, j.w.c.vanlint@tudelft.nl

1 - Application of Kalman Filter in Traffic Management and Control

Hans van Lint, Associate Professor, Delft University of Technology, Stevinweg 1, Delft, 2628CN, Netherlands, j.w.c.vanlint@tudelft.nl

In many areas of traffic management and control the variables that are of most interest are often the ones that are most difficult to measure and estimate. Take for example vehicular density (veh/km) and space-mean speed (km/h). A reliable real-time estimate of these quantities is critically important for real-time control of traffic networks. However, neither can be straightforwardly deduced from available sensor data. Similarly elusive quantities are origin-destination flows. These depict the amount of vehicles per hour planning to go from one place to another at a certain moment. Unless we literally know the origin and destination of \textit{all} vehicles on a traffic network, advanced estimation techniques are required to extract OD patterns from whatever available data and prior knowledge we have available. One intuitive and highly effective method to solve these types of problems (i.e. estimating a quantity x when all we have are observations y and prior knowledge about the process) is the Kalman Filter, first proposed by Rudolf Kalman in 1960. In this TutORial we explain with many examples how this technique can be applied in the domain of traffic management and control to solve real-world problems. We'll see that Kalman filtering is a powerful technique, that works surprisingly well in many cases, but there are also clear limitations that relate to the many assumptions underlying its application.

■ SD17

17- West 208 B- CC

Panel Discussion: Design Thinking for Creating a Capstone Course in Management Consulting

Sponsor: INFORM-ED

Sponsored Session

Chair: Paul Szwed, Professor, U.S. Coast Guard Academy, Department of Management, 15 Mohegan Avenue, New London, CT, 06320, United States of America, Paul.S.Szwed@uscga.edu

1 - Using Design Thinking to Create Meaningful Learning Experiences

Moderator: Paul Szwed, Professor, U.S. Coast Guard Academy, Department of Management, 15 Mohegan Avenue, New London, CT, 06320, United States of America, Paul.S.Szwed@uscga.edu, Panelists: Laurel Goulet, Charles Coiro

How do you go about developing a new course or improving an old one? One emerging method is to use concept and principles from design thinking. We had an award-winning capstone business consulting course that we knew was no longer getting us the desired results. Using design thinking concepts and principles, we conducted a "deep dive" on our course and developed an entirely new model. We will share the philosophies used and our experiences and lessons learned. Design thinking can be applied to a wide variety of courses or even modules in virtually any discipline.

■ SD18

18- West 208 A- CC

Simulation for Transportation and Reliability

Contributed Session

Chair: Bex G. Thomas, Researcher, General Electric Global Research Center, 1 Research Center, Niskayuna, NY, 12309, United States of America, thomasb@ge.com

1 - Incentives for Pedestrian Crossing Behavior with Vehicle Interactions under Unsignalized Conditions

Hui Xi, The University of Arizona, 1127 E. James E, Rogers Way, Tucson, AZ, United States of America, huix@email.arizona.edu, Young-Jun Son

Pedestrian crossing behavior under unsignalized conditions has been recognized as a main reason of pedestrian-vehicle crashes. This paper analyzes the incentives to prevent pedestrian jaywalking and their impact on pedestrian safety. By considering heterogeneous behaviors of drivers and pedestrians as well as their interactions under various scenarios, we intend to identify the significant variables that help improve comfort and convenience as well as safety of pedestrian crossing.

2 - Simulation of Container Truck-sharing Service (TSS): Reducing Empty Slots for Capacity Improvement

Samsul Islam, University of Auckland, ISOM Department, 12 Grafton Road, Auckland, New Zealand, misl086@aucklanduni.ac.nz, Tava Olsen

Little attention has been paid by researchers to formulating strategies to resolve the issue of empty container-truck hauling, which decreases the system-wide truck transport capacity. The objective of this simulation paper is to perform and demonstrate scenario testing to compare three main strategies. These strategies include a dynamic truck sharing facility for an internet-based matching system to assign exporters to truckers to solve the empty-truck issue.

3 - Modeling Life Cycle Performance of Asbestos Cement Water Mains

Kent Kostuk, University of Saskatchewan, 57 Campus Drive, Saskatoon, SK, S7N 5A9, Canada, kent.kostuk@usask.ca, Gordon Sparks

Municipalities in developed countries are facing a looming infrastructure crisis. Because of their visibility, roads and bridges are often the first infrastructure assets that come to mind. But buried infrastructure, such as water mains, are also decaying. To help quantify future costs and to identify ways to better manage and control these costs, a simulation model of an urban subdivision was developed.

4 - Estimating Warranty Reserves for Photovoltaic Modules using Simulation Modeling and Analysis

Bex G. Thomas, Researcher, General Electric Global Research Center, 1 Research Center, Niskayuna, NY, 12309, United States of America, thomasb@ge.com, Rajesh Tyagi

GE Solar manufacturers and sources modules to be used within PV systems or resells it to end customers. The reliability and performance of these modules is guaranteed through product warranties and guarantees. We have developed a simulation based approach to estimate the warranty reserves over time that accounts for product specifications, manufacturing information, product reliability, product durability, warranty terms and associated costs. We highlight the advantages of our approach.

■ SD19

19- West 211 A- CC

Joint Session Healthcare Logistics/SPPSN: Routing and Resource Allocation Applications in Disaster Relief

Cluster: Healthcare Logistics & Public Programs, Service and Needs

Invited Session

Chair: Ashlea Bennett Milburn, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, United States of America, ashlea@uark.edu

1 - Online Point of Distribution Location in Disaster Relief

Ashlea Bennett Milburn, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, United States of America, ashlea@uark.edu, Chase Rainwater

Information regarding affected populations, roads, buildings, and bridges becomes known on a rolling basis in the hours following a disaster. We develop online models that use real-time information regarding demand and infrastructure status to specify shelter locations and supply distribution points as a specific damage scenario is realized. Approximate solution approaches are employed to obtain good plans quickly. Computation results are presented for a New Madrid earthquake scenario.

2 - Can Social Media Information Improve Disaster Relief Routing Plans?

Emre Kirac, PhD Student, University of Arkansas, Department of Industrial Engineering, Fayetteville, AR, United States of America, ekirac@uark.edu, Clarence Wardell, Ashlea Bennett Milburn

This research examines the impact of incorporating two distinct classes of information regarding the location and need of individuals impacted by a disaster when routing vehicles to deliver relief supplies: verified requests obtained through traditional means, and unverified requests obtained from social media. Competitive ratio analysis is performed for alternative decision approaches and computational results for a wide variety of disaster scenarios are presented.

3 - Developing a Dynamic Emergency Response Plan for a Post-earthquake Scenario

Shuva Ghosh, Doctoral Candidate, Missouri University of Science and Technology, 223 Engineering Management Building, Rolla, MO, United States of America, sg2mb@mst.edu, Abhijit Gosavi

An effective emergency response plan can play a vital role in minimizing risk to the people affected when an earthquake strikes. Emergency resources are generally stored in multiple responding centers. Emergency management personnel have to select an optimal combination of responding centers to respond effectively in a dynamically evolving situation. In this work, we integrate inputs from a so-called domino-effect analysis within a semi-Markov decision process to develop a response plan.

■ SD20

20- West 211 B- CC

Optimization

Sponsor: Telecommunications

Sponsored Session

Chair: Yavuz Gunalay, Bahcesehir University, Faculty of Economics and Admin Science, Besiktas, Istanbul, 34353, Turkey, yavuz.gunalay@bahcesehir.edu.tr

1 - Using Cross-entropy for Solving the Stochastic Shortest Path Problem

Adji Cisse, Texas Tech University, Box 43061, Lubbock TX 79409, United States of America, gnouma.cisse@ttu.edu, Timothy Matis

In this presentation, we show how Cross-Entropy methods may be used to find the stochastic shortest path through a networks. At the core of this approach is the use of truncated saddlepoint approximations for the distribution of path lengths.

2 - Uncertainty and Risk Analysis in Federal Cost Estimating Agencies

Tomeka Williams, Senior Operations Research, Optimum Performance Solutions, 2486 Glengyle Drive, Vienna, VA, 22181, United States of America, tomeka.williams@gmail.com

Uncertainty and risk analysis is a process that is unique, tailorable, and often times misunderstood within Federal Departments and Agencies. In working in three different cost estimating organizations, each has had several initiatives to bridge that gap. This session is intended to share the initiatives of each of these agencies, and practical tools that have been employed to ensure that uncertainty and risk analysis is included in Federal cost estimating products.

3 - Probabilistic Interpretation for the Elasticity of Carried Load Revenue from the Erlang Loss Model

William Massey, Professor, Princeton University, Sherrerd Hall Princeton University, Princeton, NJ, 08540, United States of America, wmassey@princeton.edu

Suppose that we know the demand function for some telephone service as a function of the phone rate. If we model the number of busy channels as an Erlang loss model, then we have a formula for the carried load revenue rate as a function of this price rate. The explicit formula for the elasticity of this carried load rate can be expressed in terms of the elasticity of the corresponding offered load rate.

■ SD21

21- West 212 A- CC

Clique Relaxations in Networks

Sponsor: Optimization/Networks

Sponsored Session

Chair: Sergiy Butenko, Associate Professor, Texas A&M University,Industrial & Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States of America, butenko@tamu.edu

1 - New Developments in Finding Maximum 2-clubs in Graphs

Foad Mahdavi Pajouh, Oklahoma State University, Industrial Engineering and Management, 322 Engineering North, Stillwater, Ok, 74075, United States of America, mahdavi@okstate.edu, Illya Hicks, Baski Balasundaram

A k-club is an induced subgraph of diameter at most k which is a distance-based graph-theoretic generalization of a clique. The k-clubs can be used to model clusters in social networks, biological networks and internet graphs. This talk will outline the research challenges associated with k-club model because of its non-hereditary nature. New complexity results, theoretical results concerning the 2-club polytope and preliminary numerical results will be presented.

2 - Degree-bounded Vertex Partitions

John Arellano, Rice University, 6100 Main St., Houston, TX, 77005-182, United States of America, jda2@rice.edu, Illya Hicks, Benjamin McClosky

This paper studies degree-bounded vertex partitions, derives analogues for well-known results on the chromatic number, and presents two algorithms for constructing degree-bounded vertex partitions. The first algorithm minimizes the number of partition classes. The second algorithm minimizes a weighted sum of the partition classes, where the weight of a partition class depends on the level of adjacency among its vertices.

3 - Algorithms for Computing Optimal Clique Relaxation Structures that are Hereditary

Chitra Balasubramaniam, 401 Stasney STreet, Apt 605, College Station, TX, 77840, United States of America, bcvaidyanath@neo.tamu.edu, Sergiy Butenko, Baski Balasundaram, Svyatoslav Trukhanov

Heredity is a fundamental property of cliques that is in the core of some of the most successful combinatorial algorithms for the maximum clique problem. We use this observation to develop exact algorithms for computing maximum weight hereditary clique relaxation structures, such as s-plex and s-defective clique.

■ SD22

22- West 212 B- CC

Multilevel/Multistage Programming Applications

Sponsor: Computing Society

Sponsored Session

Chair: Soheil Hemmati, PhD Student, University of Florida, 406 Weil Hall, Gainesville, FL, 32603, United States of America, soheilmn@ufl.edu

1 - An Algorithm for Solving Inverse Integer Programs

Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Aykut Bulut

An inverse optimization problem is that of determining the smallest perturbation in a given objective function required to make a given solution optimal. In this talk, we introduce the inverse mixed integer linear programming problem, discuss its complexity, and propose a general algorithm for solving it. The relationship to bilevel programming will also be explored.

2 - Selecting Land Preserves to Enable Species Migration

Jorge Sefair, PhD Student, University of Florida, Department of Industrial & Systems Eng., Gainesville, FL, United States of America, j.sefair@ufl.edu, Miguel Acevedo, Robert Fletcher, . Cole Smith

We consider a problem in which a species migrates randomly among a network of patches across some region. Development on these patches negatively influences the probability that an organism survives when it moves to a patch, and if a critical set of patches is selected for development, the survival of the species becomes threatened. Our research presents a three-stage optimization model for optimally protecting patches so that the worst-case impact of land development is mitigated.

3 - A Parametric Integer Programming Algorithm for Bilevel Mixed Integer Programs

Chris Ryan, University of Chicago, Chicago, IL, United States of America, chris.ryan@chicagobooth.edu, Matthias Koeppe, Maurice Queyranne

We consider discrete bilevel optimization problems where the follower solves an integer program with a fixed number of variables. Using recent results in parametric integer programming, we present fixed-dimension polynomial time algorithms for pure and mixed integer bilevel problems.

4 - Mixed-integer Bilevel Programming (MIBLP) Approach for Competitive Prioritized Set Covering Problem

Soheil Hemmati, PhD Student, University of Florida, 406 Weil Hall, Gainesville, FL, 32603, United States of America, soheilmn@ufl.edu, J. Cole Smith

In competitive set covering problem, which has several applications, including non-cooperative product introduction, two players aim to maximize their rewards by selecting sets of items to satisfy clauses. Each selected item incurs a cost to players and each clause is satisfied by the highest-priority selected item, yielding a reward for the player that introduced the item. We propose an MIBLP model with 0-1 decision variables appear in both levels, and suggest an exact cutting-plane algorithm.

■ SD23

23- West 212 C- CC

Panel Discussion: Managing a Career in OR

Sponsor: CPMS, The Practice Section

Sponsored Session

Chair: Peter Bell, Professor, University of Western Ontario, Richard Ivey School of Business, London, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca

1 - CPMS Practitioners Offer Tips for Success

Moderator: Peter Bell, Professor, University of Western Ontario, Richard Ivey School of Business, Londo, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca, Panelists: Nicholas Nahas, Manoj K. Chari, Doug Samuleson, Vijay Mehrotra

This panel will share why advanced analytics are needed today more than ever. Business leaders lack abilities to apply analytical tools and data structure to address their challenges. Despite years of talk about scorecards and metrics, most organizations still rely on gut feelings and experience for urgent critical matters. We can glean insights from data and guide them along innovative ways as analytical thinking can lead their organization into the future.

■ SD24

24- West 213 A- CC

Empirical Research in Health Care Operation

Sponsor: Health Applications Society

Sponsored Session

Chair: Lijie Song, MIT-Zaragoza International Logistics Program, Edificio N·yade, 5 C/ Bari 55, PLAZA, Zaragoza, 50197, Spain, lsong@zlc.edu.es

1 - Physician Variation in Resource Utilization

Jillian Berry, Doctoral Candidate, Harvard University, Soldiers Field, Boston, MA, 02478, United States of America, jberry@hbs.edu, Anita Tucker

We study the variation in physician resource utilization in two academic Emergency Departments (ED) and how this variation is affect by resource availability.

2 - Building Flexibility in US Healthcare Delivery through Medical Tourism

Muer Yang, Assistant Professor, University of St. Thomas, 1000 LaSalle Avenue, SCH 435, Minneapolis, MN, 55403, United States of America, yangmuer@stthomas.edu, Sameer Kumar

Medical tourism is a large and growing phenomenon. In 2011 the medical tourism market was an estimated $20 billion, up from under $2 billion in 2005. The combination of cheap price and good medical care has caused an increasing number of Americans to choose medical tourism. We develop a mathematical model illustrated through discrete event simulation to show the impact of medical tourism on the cost and effectiveness of US healthcare delivery system.

3 - Partially Flexible Operating Rooms

Yann Ferrand, Assistant Professor, Clemson University, Department of Management, Sirrine Hall, Clemson, SC, 29634, United States of America, yferran@clemson.edu, Michael Magazine, Uday Rao

When organizing the operating theatre and scheduling surgeries, hospitals face a trade-off between the need to be responsive to emergency cases and to conduct scheduled elective surgeries efficiently. We develop a simulation model to compare resource-allocation policies of complete flexibility, and of complete focus, and compare them to hybrid partial flexibility policies. We evaluate these policies on patient and provider outcome measures, including patient wait time and physician overtime.

4 - Understanding Client Preferences for Preventive Care

Lijie Song, MIT-Zaragoza International Logistics Program, Edificio Náyade, 5 C/ Bari 55, PLAZA, Zaragoza, 50197, Spain, lsong@zlc.edu.es, Vedat Verter, Beste Kucukyazici

We studied a government-funded breast cancer screening program in Montreal, using stated preference discrete choice modeling as framework. This enables us to better understand the clients' preference concerning facility attributes. Incorporating our findings in a simulation model, we are able to generate managerial insights on how to improve the participation to such programs.

■ SD25

25- West 213 B- CC

Chemotherapy Patient and Resource Management in Oncology Clinics

Sponsor: Health Applications Society

Sponsored Session

Chair: Lewis Ntaimo, Associate Professor, Texas A&M University, 3131, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

Co-Chair: Tanisha Cotton, Doctoral Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, tanbgreen05@neo.tamu.edu

1 - Uncertainty in Chemotherapy Patient Scheduling

Sara Shashaani, ISE PhD Student, Virginia Technical University, Blacksburg, VA, United States of America, sshashaa@vt.edu, Mark Lawley, Ayten Turkcan, Hong Wan

Chemotherapy patient scheduling is a complex problem due to varying treatment lengths and nursing requirements, unpredictable same-day cancellations and unscheduled add-ons. Sensitivity analysis of uncertainties in the workflow is studied using a discrete-event simulation model to distinguish the stochastic elements that impose significant changes in the performance of the system when they encompass variability. Changes to the current deterministic scheduling model are proposed for flexibility.

2 - Multi-criteria Nurse Assignment for Chemotherapy Patients in Oncology Clinics

Ayten Turkcan, Northeastern University, Boston, MA, United States of America, A.Turkcan@neu.edu, Bohui Liang

In oncology clinics, nurses with different skills are assigned to patients with different acuities to administer the chemotherapy. It is important to have a reasonable nurse workload for several reasons such as patient safety, quality of care, patient and staff satisfaction. We propose a multi-objective integer programming model with the objectives of balancing workload among nurses, and minimizing waiting time and overtime. We also propose a genetic algorithm to reduce the computation times.

3 - Mean-risk Stochastic Optimization Approach for Chemotherapy Scheduling

Tanisha Cotton, Doctoral Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, tanbgreen05@neo.tamu.edu, Michelle M. Alvarado, Eduardo Perez, Lewis Ntaimo

Oncology clinics face tight resource and scheduling constraints due to increased demand, cyclic chemotherapy treatment plans, and complex and uncertain duration of treatments. This talk presents the model and results of using a risk neutral and risk averse two-stage stochastic optimization approach to efficiently schedule chemotherapy nurses, patients, and chairs based on a real oncology clinic.

4 - Modeling and Simulation of an Oncology Clinic using DEVS

Michelle M. Alvarado, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, michelle.mcgaha@gmail.com, Eduardo Perez, Tanisha Cotton, Lewis Ntaimo

Scheduling of chemotherapy treatments is a difficult task due to the cyclic nature of the prescribed treatment regimen, variability of treatment lengths, and patient acuity levels. We present a discrete event system specification (DEVS) simulation model integrated with a stochastic mixed integer programming model (SMIP) to schedule and manage patients in an oncology clinic. Preliminary results are presented from the management perspective.

■ SD26

26- North 221 A- CC

Effective Decision-making in Pricing and Inventory Control

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Esma Gel, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States of America, esma.gel@asu.edu

1 - A Comparison of Integrated Inventory/Outbound Dispatch Policies

Sila Cetinkaya, Texas A&M University, College Station, TX, United States of America, sila@tamu.edu, Bo Wei

We present an analytical comparison of alternative dispatch policies in the context of integrated inventory replenishment and outbound dispatch scheduling decisions. We prove that under the same expected replenishment cycle length and the same expected dispatch cycle length, quantity-based dispatching achieves the least inventory cost and waiting cost within one replenishment cycle, and, hence, it is superior to hybrid dispatching.

2 - Leveraging Future Cost Reductions: A Dynamic Two-Sided Pricing Model

Xiajun Amy Pan, University of Florida, United States of America, amypan@ufl.edu, Mei Lin

Technology innovation engenders new products of higher qualities and reduces production costs. We study how a firm leverages future cost reductions to position its product line toward the high-end in both buyer-side only and two-sided markets. We find that future cost reductions raise the optimal price of the current device and trigger an intertemporal buyer-side demand shift forward.

3 - Increasing Revenues from Parking Tickets

Nichalin Summerfield, Adjunct lecturer, University of Arizona, 1130 E. Helen Street, Mclnd 430, Tucson, United States of America, nichalin@email.arizona.edu, Morris Cohen, Moshe Dror

Parking inspection is modeled as a revenue collecting Chinese Postman Problem. This approach maximizes expected revenues. We investigate online rules that allow the enforcement officers to adjust their routes in response to the observed parking permits' times. Allowing an officer to selectively wait by legally parked cars till their permit expires could increase the expected revenues by 7%.

4 - Price and Lead Time Quotation for Contract and Spot Customers

Baykal Hafizoglu, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, baykal@asu.edu, Pinar Keskinocak, Esma Gel

We consider dynamic price and lead time quotation for a make-to-order company with demand from contract customers as well as spot purchasers. Contract customers are offered a uniform price and lead time, whereas, spot purchasers are subject to dynamically quoted price and lead times. We discuss the potential of dynamic quotation for such environments, various properties of optimal control policies and the optimal mix of contract customers and spot purchasers.

■ SD27

27- North 221 B- CC

Consumer Behavior Issues in Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Omar Besbes, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu

Co-Chair: Ilan Lobel, New York University, Stern Business, 44 W 4th St, New York, NY, United States of America, ilobel@stern.nyu.edu

1 - The Perils of Rationing under Consumer Regret and Misperception of Availability

Yanchong Karen Zheng, Massachusetts Institute of Technology, Sloan School of Management, 100 Main Street, Cambridge, MA, United States of America, yanchong@mit.edu, Ozalp Ozer

We study the impact of consumers' regret and misperceived product availability on a firm's inventory decision under a markdown policy. We show that both factors greatly reduce the need for rationing. They act as complements on the seller's profit when consumers are modestly risk-averse and markdown is substantial. In contrast, they act as substitutes for highly risk-averse consumers. Ignoring these factors can subject the seller to the peril of over-rationing and lead to excessive profit losses.

2 - Strategic Stock-Outs with Social Learning

Yiangos Papanastasiou, PhD Candidate, London Business School, Regent's Park, London, NW14SA, United Kingdom, Nicos Savva, Nitin Bakshi

We study a monopoly firm selling its product to customers holding uncertain, heterogeneous valuations. Limited availability induces customer self-selection, with high-valuation customers exerting effort to obtain the product first. We account for social learning and demonstrate that by inducing an early supply shortage, a firm can optimally control the information signal emitted from early reviews. Thereby, the firm can closely mimic dynamic pricing outcomes while charging a fixed price.

3 - Dynamic Pricing Without Priors

Ying Liu, New York University, 44 West 4th Street, New York, NY, United States of America, yliu2@stern.nyu.edu, Rene Caldentey, Ilan Lobel

We consider a setting where a firm is selling a limited inventory of items over time to strategic customers, but it does not have a prior on the customers' distributions of values. We construct policies that minimize the maximum regret the firm could face and present structural properties of such pricing policies.

4 - Cheap Talk in Queues with Multiple Customer Classes

Gad Allon, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo

We examine the problem of information communication by considering a model in which both the firm and the customers act strategically. In this model, the customers are heterogeneous both with regards to their waiting cost and the value they obtain from the service. The customer type is private information. We characterize the equilibrium language that emerges between the service provider and her customers.

■ SD28

28- North 221 C- CC

Models of Customer Behavior

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Xuanming Su, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States of America, xuanming@wharton.upenn.edu

1 - Consumer Bounded-Rationality: Evidence from the Click Stream Data

Jun Li, University of Pennsylvania, The Wharton School, Philadelphia PA 19104, United States of America, lijun1@wharton.upenn.edu, Serguei Netessine

Using click stream data of online search for air travels, we study how price volatility affects strategic purchase delays and search frequencies.

2 - Capacity Investment under Bankruptcy Risk with Forward-Looking Consumers

Robert Swinney, Associate Professor, Graduate School of Business, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, swinney@stanford.edu, Song Alex Yang, Erica Plambeck

We consider the capacity investment decision of a firm that is in financial distress and may enter bankruptcy. Consumers value firm survival and experience a loss in utility if bankruptcy occurs. Thus, forward-looking consumers anticipate the risk of bankruptcy and may delay a purchase to see whether the firm survives. We analyze optimal capacity decisions in this setting and determine the impact of such strategic customer behavior on the firm's profit, survival probability, and capacity level.

3 - Social Comparisons in Service Cohorts

Guillaume Roels, Assistant Professor, UCLA, 110 Westwood Plaza, Los Angeles, 90095, United States of America, guillaume.roels@anderson.ucla.edu, Xuanming Su

We study the effect of social comparisons on individual performance in service cohorts such as arise in education, health care, and sports industry. We consider two kinds of social comparison depending on whether customers experience a disutility from under-performing or a utility gain from over-performing relative to their peers. We discuss how a service provider should manage her service to enhance or mitigate the effect of social comparison.

4 - Pricing Restaurant Reservations
Jaelynn Oh, University of Pennsylvania,
The Wharton School, Philadelphia, PA, United States of America,
jaelynn@wharton.upenn.edu, Xuanming Su

Many restaurants offer reservations to delay sensitive customers and charge a fee for no-shows. Strategic customers make a reservation only when the expected utility of doing so is greater than that of walking in without a reservation. We study the restaurant's pricing problem when serving both reservation holders and walk-in customers. We characterize equilibrium prices and profits and discuss model implications.

■ SD29

29- North 222 A- CC

Staffing and Scheduling in Healthcare Operations

Cluster: Workforce Management

Invited Session

Chair: Arvind Sainathan, Assistant Professor, Nanyang Business School, Nanyang Technological University, S3-B2A-03, 50 Nanyang Avenue, Singapore, Singapore, asainathan@ntu.edu.sg

1 - Capacity Allocation between Appointments and Walk-ins with Endogenous Patient Choice
Sarang Deo, Assistant Professor, Indian School of Business,
Gachibowli, Hyderabad, 500032, India, Sarang_Deo@isb.edu,
Aditya Jain

We consider a healthcare system, wherein each patient decides the mode of arrival (appointment vs. walk-in) depending on the resulting waiting times (indirect vs. direct) as well as the severity of patient's condition. The healthcare provider decides the allocation of capacity between walk-in and appointment slots. We analyze the equilibrium of this game and derive managerial insights about the impact of patient characteristics on capacity allocation decisions.

2 - Multi-objective Robust Adaptive Scheduling for Hospital Staffing
Kibaek Kim, Northwestern University, 2145 Sheridan Rd., C210,
Evanston, IL, 60208, United States of America,
Kibaek.kim@u.northwestern.edu, Jonathan Turner,
Sanjay Mehrotra

For given mid-term (or long-term) schedules, it is necessary to make short-term adjustments, either by rescheduling staffs when shortages are anticipated or by canceling staffs when patient volume drops are anticipated. We develop a multi-objective robust adaptive scheduling model for the hospital staffing problem.

3 - Hospital Inpatient Design: Analysis and Insights
Mabel Chou, NUS Business School, Level 8, Biz1, Singapore,
Singapore, mabelchou@nus.edu.sg

We study the patient flow management in an inpatient department of a Singaporean hospital and discuss how to design the system to make the planning more cost effective. Our analysis generates a number of managerial insights for inpatient management.

4 - Scheduling Patients by Improving Open Access (same day appointment) Policy in a Family Medicine Clinic
Abraham Seidmann, Professor, Simon School of Business,
University of Rochester, CS 3-333C, Rochester, NY, 14627,
United States of America, avi.seidmann@simon.rochester.edu,
Balaraman Rajan

We present new empirical and analytical results of our research that focuses on improving the Open Access (same day appointment) models for scheduling patients in a family practice setup. We show the value of dynamically incorporating the effect of anticipated behavior of patients on the expected load of the clinic.

5 - Nurse Absenteeism and Staffing Strategies for Hospital Inpatient Units
Wen-Ya Wang, University of Minnesota, 111 Church Street S.E.,
Minneapolis, MN, United States of America, wenya@ie.umn.edu,
Diwakar Gupta

We develop models for determining the number of nurses to assign to inpatient units when nurse absentee rates are heterogeneous. The assumption of heterogeneous absentee rates is supported by a detailed analysis of data from multiple nursing units of two hospitals. We establish structural properties of an optimal nurse assignment strategy and propose heuristics that perform well in numerical experiments.

■ SD30

30- North 222 B- CC

Energy and Commodity Real Options

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Nicola Secomandi, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, ns7@andrew.cmu.edu

Co-Chair: Selvaprabu Nadarajah, Tepper School of Business, Carnegie Mellon University, 5000Forbes Avenue, Pittsburgh, PA, 15213, United States of America, snadarajah@cmu.edu

1 - Storage Operations and Investments in an Electrical System
Santhosh Suresh, PhD, Ross School of Business, University of
Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of
America, sssandy@umich.edu, Roman Kapuscinski, Owen Wu

Storage technology is becoming increasingly prevalent in today's electric grid. We discuss the optimal siting and sizing of storage units in the view of minimizing overall operating costs accounting for transmission losses unlike individual profit maximization setting in most previous literature. We show the degree of storage pooling to be related structurally with: the efficiency of storage and transmission, variance, correlation and mean in the demand distribution; using a three node model.

2 - Valuing Renewable Energy Resources
Michael Pavlin, Assistant Professor, Wilfrid Laurier University,
75 University Avenue West, Waterloo, ON, Canada,
Michael.Pavlin06@Rotman.Utoronto.Ca, John Birge

Wind, solar, and other renewable energy resources such as tides and rain have intermittent availability that makes effective operation and valuation challenging. We consider the valuation of wind generation for electricity given the structure of this market and the risk associated with commitment to production.

3 - Managing Wind-based Electricity Generation with Storage and Transmission Capacity
Yangfang Zhou, PhD Candidate, Carnegie Mellon University,
5000 Forbes Ave., Pittsburgh, PA, 15213 United States of America,
yangfang@andrew.cmu.edu, Alan Scheller-Wolf,
Nicola Secomandi, Stephen Smith

We consider the problem of operating wind-based electricity generation with storage (for instance, a grid-level electricity battery) in a market. We demonstrate that mismanaging such a system can significantly reduce its value. We also show that storage can greatly increase the monetary value of the wind farm, and, while it typically increases the total energy sold to the market, in certain situations it may also— paradoxically—decrease the total wind energy sold to the market.

4 - Valuing Multiple Exercise Options using Term Structure Models and Approximate Dynamic Programming
Selvaprabu Nadarajah, Tepper School of Business, Carnegie Mellon
University, 5000 Forbes Avenue, Pittsburgh, PA, 15213,
United States of America, snadarajah@cmu.edu, Francois Margot,
Nicola Secomandi

We develop computationally efficient least squares Monte Carlo (LSM) and approximate linear programming (ALP) methods for valuing multiple exercise, such as energy swing and storage, options, using term structure price models. Our theoretical and numerical investigation shows the superiority of an LSM version based on value, rather than continuation value, function approximation. We also structurally relate our LSM and ALP methods. This suggests further research on optimal ALP relaxations.

■ SD31

31- North 222 C- CC

Control the Inventory Risk of Stockout

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Jim Shi, Georgia State University, College of Business, Atlanta, GA, United States of America, shigsu@gmail.com

1 - Stock-out Risk Control of the Production-Inventory System with Compound Poisson Demands
Jim Shi, Georgia State University, College of Business, Atlanta, GA,
United States of America, shigsu@gmail.com

We study a single-product continuous-time production-inventory system with a constant replenishment rate, compound Poisson demands and lost-sales. The objective is first to derive the expected discounted inventory cost until the stockout occurrence for any given initial inventory level so as to investigate the stockout risk.

2 - The Effects of Risk Aversion and Service Constraints on a Two-period Newsvendor Policy

Tatyana Chernonog, Bar Ilan University, Ramat Gan, 52900, Israel, Tatyana.Chernonog@biu.ac.il, Matan Shnaiderman

This paper presents a two-period newsvendor problem with postponed pricing strategy. Risk aversion and service constraints are taken into account. These constraints may affect the optimal inventory capacity as well as the optimal prices. The effects of the constraints on supply chain performance are compared. The current two-period model leads to complicated and non-trivial solutions and insights, compared with one-period models, found in the literature. Exact analytical formulas are given.

3 - A Risk-averse Dynamic Inventory Model with Fluctuating Purchasing Costs

Sungyong Choi, Assistant Professor, Yonsei University, 1 Yonseidae-gil, Wonju, 220-710, Korea, Republic of, sungyongchoi@gmail.com

In my work, dynamic consumption models are studied for finite and infinite time Markov Decision Process (MDP) problems with fluctuating purchasing costs. I use additive general and exponential utility functions with finite and infinite time horizons. In addition, we assume that purchasing costs follow a discrete-state Markov chain. Then, I consider parametric sensitivity analysis for the model parameters using super-modularity.

■ SD32

32- North 223- CC

Topics in Manufacturing I

Contributed Session

Chair: Sharafali Moosa, Associate Professor of OM (Edn.), LKC School of Business, Singapore Managment University, 50 Stamford Road, Singapore, 178899, Singapore, sharafalim@smu.edu.sg

1 - Wire Path Planning for Multi-axis Wire EDM

Zhi Yang, Kimberly Clark, 1400 Holcomb Bridge Road, Roswell, GA, 30076, United States of America, zack.yang@kcc.com, Richard A. Wysk, Sanjay Joshi

Wire path generation methods are introduced. Cutting wire trajectories are generated under each specified coordinate system based on tangent visibility results. In order to accomplish the lead-in/lead-out wire path generation automation, an algorithm is developed to find paths for different types of tangent visibility results. A cut off plane is introduced to generate the cut off wire path as the final step of machine operation.

2 - 3D Layout Optimization with Flexible Objects

Sima Maleki, PhD Candidate, University of Tennessee, 416 East Stadium Hall, Knoxvile, TN, 37996, United States of America, smaleki@utk.edu, Rapinder Sawhney

This work addresses the multi-layer 3-dimensional packaging of flexible objects and containers with the aim of maximizing the space utilization. The flexible containers are filled with rigid and non-rigid objects. Then, the containers are packed in a bin with fixed size. The problem of filling up containers with heterogeneous objects and locating the containers in a bin is formulated as a Mixed Integer Linear Programming model. Results illustrate the effectiveness of the layout.

3 - Modelling Geometric Variation of Compliant Sheet Metal Assembly using Statistical Modal Analysis

Abhishek Das, University of Warwick, International Digital Laboratory, WMG, Coventry, CV4 7AL, United Kingdom, Abhishek.Das@warwick.ac.uk, Darek Ceglarek

Efficient modelling and analysis of geometric variation is crucial for quality control of deformable assemblies in automotive and aerospace industries, especially for emerging technologies such as remote laser welding. Statistical Modal Analysis using discrete-cosine-transformation is presented through a case study. The approach models modes of deformation for developing surface-based SPC.

4 - A Failure-prone System with Delivery Deadline and Outsourced Maintenance

Sharafali Moosa, Associate Professor of OM (Edn.), LKC School of Business, Singapore Managment University, 50 Stamford Road, Singapore, 178899, Singapore, sharafalim@smu.edu.sg, Hakan Tarakci, Shailesh Kulkarni

We consider a production-maintenance system which is subject to random breakdowns. The manufacturer has to offer a firm delivery deadline to her customer. She also has to decide on the maintenance decisions with a maintenance contractor. A regenerative stochastic process is identified and analysed to develop the cost function over the finite horizon. Numerical examples will illustrate the optimization problem. Some managerial insights with regard to coordination will also be provided.

■ SD33

33- North 224 A- CC

Joint Sessions MSOM/ENRE: Modeling & Optimization for Electric Vehicles

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations & Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Mustafa Dogru, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, mustafa.dogru@alcatel-lucent.com

1 - Optimal Location of Public Electric Vehicle Charging Infrastructure

Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu, Xiaomin Xi, Vincenzo Marano

We develop a simulation optimization based approach to optimize the location of public electric vehicle charging infrastructure. The model includes budget constraints and accounts for driving and charging behavior. We use a case study based on the central Ohio region to demonstrate the model.

2 - Modeling and Optimization for Electric Vehicle Charging Infrastructure

Mustafa Dogru, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, mustafa.dogru@alcatel-lucent.com, Matthew Andrews, Yue Jin, John Hobby, Gabriel Tucci

We have developed a modeling framework to quantify the load on the power grid due to electric vehicles (EVs) in a metropolitan area during the course of a day. Our analysis uses driving patterns as an input and utilizes the data from publicly available surveys conducted in the US. We use this information to optimize the placement of public charging stations. The analysis also allows us to determine the percentage of households that are candidates for adopting EVs given the current technology.

3 - An Integer Programming Model for Generating Vehicle Fleet Purchase Recommendations

Daniel Reich, Operations Research Analyst, Ford Motor Company, 2101 Village Road, MD 2122, Dearborn, MI, 48124, United States of America, dreich8@ford.com, Sandy Winkler, Erica Klampfl

Sustainability and environmental impact are areas of growing importance to many of Ford's fleet customers. New green vehicle technologies have emerged, which present organizations with an opportunity to increase the fuel economy of their fleets. "Fleet Purchase Planner (FPP)" (patent pending) is a software system designed to assist Ford's fleet customers in planning their purchases. This talk introduces FPP and the integer programming model we use to provide customized purchase recommendations.

4 - Controlled Plug-in Vehicle Charging in High Wind Penetration Scenarios

Jeremy Michalek, Associate Professor, Carnegie Mellon University, Scaife Hall 324, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, jmichalek@cmu.edu, Allison Weis, Paulina Jaramillo

We construct a MILP model of optimal power plant capacity expansion, dispatch, and plug-in vehicle charging to estimate the benefits of electric vehicle demand management using variable rate charging (less costly than bidirectional V2G). We estimate the implications for system cost, integration of intermittent wind power, wind curtailment avoided, and peaking plant construction avoided.

■ SD34

34- North 224 B - CC

The Architecture of Coordination

Cluster: New Product Development

Invited Session

Chair: Alan MacCormack, Harvard Business School, Soldiers Field, Boston, MA, 02163, United States of America, amaccormack@hbs.edu

1 - Innovation Analytics: using Complexity Science and Big Data for Sequencing of Products

Nitin Joglekar, Boston University, One Silber Way, Boston, MA, United States of America, joglekar@bu.edu, Edward Anderson

Many projects are sequentially dependent on one another because their features and pricing influence market tastes, and vice-versa, thus creating a complex system. Firms have begun to use "Big Data" from social media and allied sources to inform underlying decisions. We explore an information scaling framework for navigating through this complexity.

2 - Managing Distributed Product Development Projects: Integration Strategies for Language and Geography

Edward Anderson, University of Texas McCombs School of Business, 1 University Station B6500, Austin, TX, 78712, United States of America, Edward.Anderson@mccombs.utexas.edu, Xiaoyue Jiang, Aravind Chandrasekaran

We study two barriers to distributed product development work, (1) geographic distance and (2) language. Our empirical setting involves 55 projects in 20 focal firms that outsource complex innovation work to their suppliers. We investigate the effects of two integration mechanisms used to overcome these barriers, (1) colocating firm and supplier personnel and (2) giving a "supply chain integrator" personnel that manage the DPD projects control over key aspects of their projects.

3 - Transparent Environments for Leaky Modules

Jim Herbsleb, Professor, Carnegie Mellon University, 5000 Forbes Avenue, 5307 Wean Hall, Pittsburgh, PA, 15213, United States of America, jdh@cs.cmu.edu, Laura Dabbish, Colleen Stuart, Jason Tsay

Design rules enable concurrent work when organizational structure mirrors the technical architecture. Perfect modularity, however, is difficult to achieve. Imperfect modularity requires ongoing coordination of inter-module dependencies. In this qualitative study, we examine how an emerging generation of workspaces, explicitly designed around transparency, expose details of ongoing work and support surprisingly rich inferences about people, activities, technical direction, and dependencies.

4 - The Human Cost of Complexity: How System Architecture Affects Developer Productivity

Alan MacCormack, Harvard Business School, Soldiers Field, Boston, MA, 02163, United States of America, amaccormack@hbs.edu, Dan Sturtevant

Prior work shows that systems with greater complexity suffer greater quality problems, in terms of experiencing defects. Few studies however, examine the human costs of complexity - that is, the impact on the productivity of system developers. We explore this relationship in a commercial software system. We find that i) developer productivity is impacted by where in the system architecture they work, and ii) only skilled developers are allowed to work on the most complex parts of the system.

■ SD35

35- North 225 A- CC

Bid Price Control in Practice

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Darius Walczak, PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dwalczak@prospricing.com

1 - Bid and List Price Trends in RM and Forward-Looking Consumers

Ming Hu, Rotman School of Management, University of Toronto, Toronto, Canada, Ming.Hu@rotman.utoronto.ca, Oded Berman, Zhan Pang

We characterize a probabilistic property of the bid price process driven by an optimal policy in a general RM framework: the bid price process always follows an upward trend. We explore a couple of applications of this structural property. For example, we show that the optimal list price process also follows an upward trend if the customers' WTP does not decrease over time. We draw implications on forward-looking behavior of strategic consumers.

2 - Randomization Approaches for Network RM with Choice Behavior

Sumit Kunnumkal, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, A.P, AP, India, sumit_kunnumkal@isb.edu

We present new approximation methods for the network RM problem with customer choice behavior. The starting point for our methods is a dynamic program that allows randomization. An attractive feature of this dynamic program is that the size of its action space is linear in the number of itineraries. We present two approximation methods that build on this dynamic program and use ideas from the independent demands setting.

3 - Estimating Mixtures of Willingness-To-Pay Distributions from Hotel Rate and Occupancy Data

Chris Keller, Assistant Professor, East Carolina University, College of Business, 3136 Bate Building, Greenville, NC, 27858, United States of America, kellerc@ecu.edu

This presentation uses daily rate and occupancy data for a mid-market hotel and it competitive set to estimate mixtures of distributions for customer willingness-to-pay. The presentation considers various numbers of mixture distributions and various types of distributions in order to maximize goodness-of-fit to observed rates and occupancies. The distributions are also collectively varied by day, week, and month.

4 - Practical Aspects of Network Bid Price Control

Darius Walczak, PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dwalczak@prospricing.com

Many network carriers rely on bid price control in their day-to-day revenue management. At the same time they are also often task with providing estimates of expected revenue, load factor or other measures. We discuss challenges that arise in deriving those business metrics under bid price control in the network setting.

■ SD36

36- North 225 B- CC

Pricing and Energy Cost of Cloud Computing Services

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Parijat Dube, IBM, TJ Watson Research Center, Hawthorne, NY, United States of America, pdube@us.ibm.com

Co-Chair: Genady Ya. Grabarnik, St. John's University, Queens, NY, United States of America, grabarng@stjohns.edu

1 - Cost Comparison between Infrastructure Cloud Services

Huan Liu, Accenture Technology Labs, 50 W San Fernando St., San Jose, CA, 95113, United States of America, huan.liu@accenture.com

Infrastructure cloud service providers, such as Amazon EC2, differ widely from each other in terms of their price structure, which makes it very difficult to perform an apple-to-apple comparison. In this paper, we describe a methodology to dissect the price structure into its individual components, including CPU, memory, and hard disk capacity. We then use the price components to compare offerings from a few dominate cloud providers.

2 - Selective Commitment and Selective Margin: Techniques to Minimize Cost in an IaaS Cloud

Yu-Ju Hong, Purdue University, 2550 Yeager Rd Apt 12-1, West Lafayette, IN, 47906, United States of America, yujuhong@purdue.edu, Mithuna Thottethodi, Jiachen Xue

We aim to minimize compute cost for day-to-day operations in an Infrastructure-as-a-Service (IaaS) cloud, while satisfying statistical response-time targets. First, a dynamic programming algorithm is used to compute load-dependent margins (a set of servers to handle unexpected load bursts). Second, we exploit the differences of price/commitment of on-demand and reserved virtual machine instances. Simulations with real Web server traces using Amazon EC2 cost model show 21% of average cost saving.

3 - Online Dynamic Capacity Provisioning in Data Centers

Minghong Lin, Caltech, 1200 E. California Blvd., Pasadena, United States of America, mhlin@caltech.edu, Adam Wierman, Eno Thereska, Lachlan Andrew, Zhenhua Liu

Power consumption imposes a significant cost for data centers, yet much of that power is used to maintain excess service capacity during periods of low load. In this work, we study how to avoid such waste via an online dynamic capacity provisioning. We show that the optimal offline algorithm has a simple structure when viewed in reverse time, and develop a lazy online algorithm which is 3-competitive. Additionally, we analyze the traditional receding horizon control and introduce a new variant.

4 - Distributed Resource Allocation in Large Scale Data Intensive Computing

Cathy Xia, Professor, Ohio State University, 210 Baker, 1971 Neil Ave., Columbus, OH, 43210, United States of America, xia.52@osu.edu, Kevin Liu, Ness Shroff

In cloud computing, distributed management of resources for effective data-intensive in-network computing is critical. We consider the optimal resource allocation problem in this context using a network utility optimization framework. We provide second-order based distributed control algorithms with guaranteed quadratic convergence speed.

5 - Energy Cost and Availability Considerations in Cloud Services Composition

Parijat Dube, IBM, TJ Watson Research Center, Hawthorne, NY, United States of America, pdube@us.ibm.com

Compute service provider has the flexibility to use its own private nodes or use nodes from public domain when composing services. However there are cost and availability concerns associated with both private nodes and public nodes. The goal is to construct compute services which satisfy end-to-end delay requirements of a job while minimizing cost and maintaining reliability. We propose simple heuristics and their empirical verification.

■ SD37

37- North 226 A- CC

Alternative Fuels, Stations, and Vehicles I

Sponsor: Location Analysis

Sponsored Session

Chair: Michael Kuby, Professor, Arizona State University, Tempe, AZ, 85287-5302, United States of America, mikekuby@asu.edu

1 - Effects of Electric Vehicles Adoption Pathway on the US Energy System

Dong Gu Choi, Georgia Institute of Technology, 765 Ferst Drive, NW, Room 336, Atlanta, GA, 30332, United States of America, doonggus@gatech.edu, Frank Kreikebaum, Deepakraj Divan, Valerie Thomas

Adoption of electric vehicles (EVs) can affect the development of the electric power system, the integration of intermittent renewable energy, and the overall efficiency of the vehicle fleet, with implications for costs, environmental impacts, and policy implementation. Using a set of models spanning the light-duty vehicle fleet and the electric power system, we evaluate numerous scenarios for EV integration into the energy system in eastern U.S. and argue linkages among the considerations.

2 - Shortest Routes with Refueling Stops

Pitu Mirchandani, Arizona State University, 699 South Mill Avenue, Tempe, AZ, 85287, United States of America, pitu@asu.edu, Jonathan Adler, Guoliang Xue

Unlike the problem of shortest paths and shortest path trees, when refueling stops are not required, and where well known algorithms exist for finding shortest path trees, the problem of finding shortest routes with refueling may require detouring for refueling, which may result in walks with cycles. A polynomial algorithm is presented for finding the set of shortest walks for all node pairs in the network.

3 - The Vehicle Scheduling Problem with Electric Vehicles

Jonathan Adler, Arizona State University, 699 S. Mill Ave., Tempe, AZ, 85281, United States of America, jonadler@asu.edu, Pitu Mirchandani

The Vehicle Scheduling Problem (VSP) consists of assigning a fleet of vehicles to travel a certain set of trips with given start and end times. VSP changes when the fleet is composed of electric vehicles, since the vehicles can only travel a limited distance before needing to recharge or exchange batteries. In this talk we will define and formulate the problem of using electric vehicles in these scheduling settings, show the problem is NP-hard, and present a heuristic solution.

4 - Distributed Joint Budget Allocation and Location Problem for Alternative-fuel Stations

Ismail Capar, Assistant Professor, Texas A&M University, TAMU 3367, College Station, TX, 77843, United States of America, capar@tamu.edu, In-Jae Jeong

Government agencies (GAs) around the world are providing grants to service providers (SPs) for building infrastructure for alternative-fuel vehicles (AFVs). While GAs aim to increase the number of adopters; SPs want to maximize profit. These objectives may not be well aligned. We consider this joint funding allocation and AFV station location problem under partial information sharing where parties do not reveal the private information of individual objective functions and budget constraints.

5 - Hydrogen Charging Station Location Analysis with Scheduling and Routing Considerations

Jamie Kang, Institute of Transportation Studies, University of California, Irvine, 4000 AIRB, Irvine, CA, United States of America, jekang@uci.edu, Will Recker

A facility location problem with full-day scheduling and routing considerations is proposed for hydrogen refueling stations in the early adoption stage. The model uses the set covering model as a location strategy, and the Household Activity Pattern Problem as the scheduling and routing tool. The formulation isolates each vehicle's routing problem from other vehicles as well as the set covering problem, and uses a modified column generation that finds a column with a negative reduced price.

■ SD38

38- North 226 B- CC

Public Services Applications

Sponsor: Service Science

Sponsored Session

Chair: Robert Saltzman, Professor, Decision Sciences, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, saltzman@sfsu.edu

1 - Planning for an Aging Fleet of Shuttle Vehicles with Simulation

Robert Saltzman, Professor, Decision Sciences, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, saltzman@sfsu.edu

A university operates an aging fleet of shuttle vehicles that facilitate travel by its affiliates to, from and around campus. This paper presents an animated discrete-event simulation model that can be used by campus planners to make capital planning decisions about the fleet. Experiments were run to identify the best type of shuttle to replace existing vehicles and to quantify how different fleet configurations might accommodate various future increases in ridership.

2 - Using Stochastic Processes and Behavioral Analysis to Support Search and Rescue Operations

Johnathon Dulin, Concurrent Technologies Corporation, 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com

Optimizing search patterns has long been a focus in the OR community, and it is generally accomplished in two veins: probabilistic analysis to develop a fixed pattern or automated learning to direct progress. But is it possible that the two could meet in the middle? In this talk we describe an approach that does just this. By merging the behavioral elements of game theory with the policy optimization of MDPs, our combined approach finds smarter search paths by allowing real-time updates.

3 - Police Control Room Emergency Response Behaviour Analysis

Partha Datta, Associate Professor, IIM Calcutta, Diamond Harbour Road, Joka, Calcutta, WB, 700104, India, ppdatta@iimcal.ac.in

The primary issue explored in this research is how demand distortions called the 'bullwhip' effect, create inefficiencies for responding to emergency calls in police control rooms. In this paper, we demonstrate the existence of bullwhip effect in the emergency service sector through case study of Indian police control room. We explore the impact of call handler's behavioral differences.

4 - Evaluating an Automatic Data Sharing Tool for Municipal Governments

Stacy Hobson, IBM T. J. Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, stacypre@us.ibm.com

Coordination of data from multiple departmental applications are critical for municipalities to provide services to its citizens, yet the prevalence of silos between applications requires significant amounts of manual data sharing. We present our work in creating the Shared Data Manager (SDM) – a tool to for loosely-coupled and customizable application integration and findings of our study on the use of the SDM as a means to improve data sharing and coordination within municipal governments.

■ SD39

39- North 226 C- CC

Electronic and Mobile Retailing Services

Sponsor: Service Science

Sponsored Session

Chair: Howard Hao-Chun Chuang, PhD Candidate, Mays Business School at Texas A&M University, College Station, TX, 77843-4217, United States of America, hchuang@mays.tamu.edu

1 - From E-commerce to M-commerce: Business Value of Mobile Sales Channel

Yen-Chun Chou, Arizona State University, United States of America, Yen-Chun.Chou@asu.edu, Benjamin Shao

M-commerce represents an emerging subset of e-commerce and is projected to reach 31 billion by 2016. While firms embrace mobile sales channels, one critical question is how they can reap values from the new channels. We aim to answer the question by considering prior e-commerce establishments, timing of mobile channel implementation, and a firm's general business operations. Our study contributes to research and practice by exploring factors that influence m-commerce performances.

2 - Visualization of Contents-oriented Services

Chie-Hyeon Lim, Pohang University of Science and Technology, Engineering Building #4-316, Pohang, Korea, Republic of, arachon@postech.ac.kr, Kwang-Jae Kim

A contents-oriented service is a type of service in which service contents have major roles in service provision. Examples include car-infotainment services and internet-based education services. This talk presents issues regarding the visualization of contents-oriented services. The conventional service blueprint and other existing tools for service visualization are reviewed for the visualization of contents-oriented services; the limitations and alternatives are also discussed.

3 - Impact of Website Functionalities on e-Retailer Sales: An Econometric Analysis

Guanyi Lu, PhD Candidate, Mays Business School at Texas A&M University, 320N, 4217 TAMU, College Station, TX, 77843-4217, United States of America, glu@mays.tamu.edu, Xiaosong Peng, Howard Hao-Chun Chuang, Gregory Heim

Utilizing a three-year panel data set of top500 Internet retailers, we examine the effects of various web functionalities on retailer sales. The results suggest that only value-added web functionalities exhibit a direct and sizable effect on web sales; the effects of fundamental and customer-centered web functionalities appear to be non-substantial.

4 - Operating Efficiency of Internet Retailers

Howard Hao-Chun Chuang, PhD Candidate, Mays Business School at Texas A&M University, College Station, TX, 77843-4217, United States of America, hchuang@mays.tamu.edu, Gregory Heim, Rogelio Oliva

We empirically assess the operating efficiency of Internet retailers using stochastic non-smooth envelopment of data. In the first stage, we adopt concave nonparametric least squares (CNLS) to tackle estimation bias incurred by contextual variables. In the second stage, we decompose CNLS residuals and derive efficiency estimates. We conclude by discussing the methodological implications of contextual variables and the managerial implications of e-retail efficiency.

■ SD40

40- North 227 A- CC

Ecosystem Conservation

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Hayri Onal, University of Illinois at Urbana-Champaign, 305 Mumford Hall, Urbana, IL, 61801, United States of America, h-onal@illinois.edu

1 - Optimal Surveillance and Eradication of Invasive Species

Robert Haight, USDA Forest Service, 1992 Folwell Ave., St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us, John Kean, Rebecca Epanchin-Niell, Andrew Liebhold, Ludek Berec

Cost-effective surveillance strategies are needed for efficient responses to biological invasions of terrestrial ecosystems. Surveillance strategies are applied in environments with continual invasion pressure, unknown number, size, and location of populations, and trade-offs between surveillance effort and management costs. We develop a decision model that accounts for these features and determines the long term equilibrium sampling effort that minimizes total expected costs of new invasions.

2 - A Modeling Framework for Life History-based Conservation Planning

Sandor Toth, Assistant Professor, University of Washington, School of Environmental and Forest Scien, Seattle, WA, 98195, United States of America, toths@uw.edu, Eileen S. Burns, Robert Haight

We present a new population protection function for reserve site selection models that determines whether minimum habitat requirements are present in a given reserve network. We embedding the function in an integer programming-based reserve selection model and apply it to a case study of Myotis bat conservation on Lopez Island, United States. Finally, we highlight the need in future reserve design models to capture intra- and inter-species competition for habitat resources.

3 - Robust Network Design for Multispecies Conservation

Bistra Dilkina, Cornell University, Ithaca, NY, 14853, United States of America, bistra@cs.cornell.edu, Ronan Le Bras, Yexiang Xue, Carla Gomes

Ideally conservation plans should ensure the connectivity of habitat areas is robust to changes in the landscape. We introduce the Shortest Maximally Connected Network Design problem, which captures the need to both protect multiple edge-disjoint paths as well as minimize the species-specific resistance length of such paths, and provide solution approaches. Our models extend to multispecies conservation, providing a tool to systematically study tradeoffs between species, in addition to costs.

4 - Designing a Conservation Reserve with Optimum Functional Connectivity

Hayri Onal, University of Illinois at Urbana-Champaign, 305 Mumford Hall, Urbana, IL, 61801, United States of America, h-onal@illinois.edu, Yicheng Wang

Spatial contiguity of conservation reserves is crucial for effective functioning of the reserved areas and improving species survival chances. Just physical contiguity may not always be adequate, quality of the connecting areas is important also. We present a linear MIP model for determining an optimal functionally connected reserve while meeting other conservation criteria and an empirical application to a real data set.

■ SD41

41- North 227 B- CC

Uncertainty in Energy

Contributed Session

Chair: Bruno Flach, RSM, IBM Research, Brazil, bflach@br.ibm.com

1 - Payment Uncertainty Management in a Combined Market of Energy and Reserve

Taìsa Felix, Universidade de Brasìlia, SHCGN 703 Bloco L apto 103, Brasìlia, BR, 70730712, Brazil, taisafelix@gmail.com

As a rule, power system markets operate considering bid cost minimization (BCM) in clearing processes. This procedure has inconsistency because the total BCM is different from the load payment. This work introduce a combined market model of energy and reserve operating under Payment Minimization (PM), transforming the problem in a bi-level linear model, which can be solved using GAMSÆ. Expected payment is evaluated using Monte Carlo simulation, providing results to evaluate the PM energy policy.

2 - Robust Unit Commitment Problem with Demand and Market Price Uncertainty

Michele Samorani, Alberta School of Business, University of Alberta, Edmonton, AB, Canada, samorani@ualberta.ca, Manuel Laguna, Fabio Furini

The unit commitment problem must be solved periodically by the grid operator in order to find the optimal energy production plan. We extend existing solution methods by taking into account the uncertainty of the demand and of the energy prices. We test the performance of robust optimization strategies on real data of energy demand. Our results suggest that significant savings can be achieved by adopting the minimax regret criterion.

3 - An MIQP Approach to the Determination of Analogous Reservoirs

Bruno Flach, RSM, IBM Research, Brazil, bflach@br.ibm.com

Oil companies are constantly faced with decision under uncertainty problems related to the analysis of potential investments in target reservoirs. Our work focuses on the determination of analogous reservoirs as a way to estimate unknown properties and production forecatsts by formulating it as a mixed integer quadratic programming (MIQP) problem. Computational results on the application of different solution algorithms to a realistic large-scale problem will be discussed.

4 - An Optimal Solution to the Discrete Price-based Dynamic Economic Dispatch Problem

Pawel Kalczynski, Professor of Inf. Syst. and Dec. Sci., California State University-Fullerton, Mihaylo College of Business and Econ., P.O. Box 6848, Fullerton, CA, 92831-6848, United States of America, PKalczynski@fullerton.edu

A new approach to the price-based dynamic economic dispatch (PBDED) of fossil-fuel electricity generators is presented; temperature is the decision variable. The objective is to maximize profit over a discrete time horizon when the fuel and electricity prices (or forecasts) are given. An optimal solution can be found using the dynamic-programming approach. The model allows for representing different types of fossil-fuel generators; it can used to compare bidding strategies and price forecasts.

■ SD42

42- North 227 C- CC

Traffic and ITS

Contributed Session

Chair: Mostafa Badakhshian, PhD Student, Concordia University, 2525 Boul Cavendish, Montreal, QC, H4B 2Y6, Canada, m.badakhshian@gmail.com

1 - Priority Traffic Signal Control in an Actuated Control System

Larry Head, Department Head, Systems and Industrial Engineering, University of Arizona, P.O. Box 210020, Tucson, AZ, 85721, United States of America, larry@sie.arizona.edu, Jun Ding, Qing He, Wei Wu

Traffic signals provide service for multiple modes of travelers including vehicles, trucks, transit, pedestrians and bicycles, and emergency vehicles. Historically, the treatment for each mode of traveler was addressed somewhat independently within the normal traffic signal operation (vehicles). This paper addresses a decision framework for prioritizing requests for service from multiple modes and accommodating the authorized requests within an integrated framework.

2 - Monitoring Traffic Shock Waves on the Roads via Massive GPS Probes

Young-Ji Byon, Assistant Professor, Khalifa University of Science Technology and Research, Al Saada St. (19th) and 4th Street, P.O. Box 127788, Abu Dhabi, 127788, United Arab Emirates, youngji.byon@kustar.ac.ae, Raja Jayaraman, Young Seon Jeong, Said Easa

Until now, intelligent transportation system (ITS) applications have focused on speed, density and volume of the general traffic on particular sections of roads. A more direct method of traffic monitoring can be achieved by capturing "shockwaves" with GPS probes. Shockwaves generally travel backwards on the road and can create grid-locks at major intersections. By monitoring the movements of the shockwaves, real-time route guidance can be improved.

3 - Travel Time Reliability for Extended Freeway Facilities

Ali Hajbabaie, Postdoctoral Research Scholar, Institute for Transportation Research and Education-North Carolina State University, 909 Capability Drive, Suite 3600, Research Building IV, Raleigh, NC, 27606, United States of America, ahajbab@ncsu.edu, Behzad Aghdashi, Nagui Rouphail

In this study, we introduce a methodology to incorporate reliability measures in travel time estimation of extended freeway facilities. The methodology is designed to account for non-recurring sources of congestion such as inclement weather events and traffic incidents. Travel time reliability method, several reliability performance measures, and numerical findings of a real-world case study will be explained.

4 - An Analytical Approximation of the Joint Distribution of Queue-lengths in an Urban Network

Carter Wang, Massachusetts Institute of Technology, 235 Albany Street, #2021, Cambridge, MA, 02139, United States of America, carterw@mit.edu, Carolina Osorio

We propose a methodology to approximate the joint distribution of queue lengths in an urban network. The main issues are dimensionality and modeling dependency analytically. We approximate network-wide joint distributions by combining a finite capacity queueing network model with an analytical aggregation-disaggregation technique. The approach is analytical and differentiable and can be embedded within optimization frameworks to address efficiently a variety of urban transportation problems.

■ SD43

43- North 228 A- CC

Joint Session RAS/CPMS: Panel Discussion Continued: Analytics and Intermodal

Sponsor: Railway Applications & CPMS, The Practice Section

Sponsored Session

Chair: Bruce Patty, Vice President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, bpatty@veritecsolutions.com

1 - Roundtable on Analytics and Intermodal

Moderator: Bruce Patty, Vice President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, bpatty@veritecsolutions.com, Panelists: Michael Gorman, Steve Sashihara, Dharma Acharya

This roundtable will take place during two sessions. During this second session, there will be three panelists from the OR community (Mike Gorman from the University of Dayton, Steve Sashihara from Princeton Consultants, and Dharma Acharya from CSX) who will share their thoughts about current and potential applications of analytics to the intermodal industry. After their opening presentations, there will be an opportunity for the audience to ask questions and participate in an open discussion.

■ SD44

44- North 228 B- CC

Information in Supply Chain

Contributed Session

Chair: Eirini Spiliotopoulou, PhD Candidate in Supply Chain Management, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Zaragoza, 50197, Spain, espiliotopoulou@zlc.edu.es

1 - Optimal Replenishment Policies for Deteriorating Items Based on the Forecasting Method of Grey Model

Shoufeng Ji, Professor, Northeastern University, No.11, Lane 3, WenHua Road, HePing District, Liaoning, Shenyang, 110004, China, sfji@mail.neu.edu.cn, Haifei Yu

The collected and forecasting profit model was briefly introduced focus on a series of conditions such as limited inventory, stochastic replenishment periods, uncertain of whether lending stock and service level constraint. Then determinate the optimal replenishment quantity and optimal policy and utilize MATLB real-time simulation to analyze how lending stock rate and stochastic replenishment periods effluence the profit .Finally it is proved that model is validated to the policy.

2 - Mechanisms to Induce Buyer Forecasting: Do Suppliers Always Benefit from Better Forecasting?

Thunyarat (Bam) Amornpetchkul, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, thunyara@umich.edu, Ozge Sahin, Izak Duenyas

We consider a supplier's contract offerings to a buyer who may obtain more precise or more accurate demand forecasts closer to the selling season. We investigate optimal contract types both when the supplier is certain and uncertain of the buyer's forecasting capability. We propose new mechanisms which effectively induce the buyer to obtain better forecasts and always yield a higher profit to the supplier, compared to conventional contract types considered in the literature.

3 - The Value of Real-time Advance Demand Information in Lot-sizing Decision Making

Qiannong Gu, Sam Houston State University, 1419 Eden Meadows Dr, Spring, TX, 77386, United States of America, qian_nong@yahoo.com, Basheer Khumawala, John Visich

Advance demand information captured by a real time information tracking technology offers an opportunity for the manufacturer in a supply chain to make more efficient lot-sizing decisions. This research studies the trade-off between lot setup costs and inventory holding costs in a lot-sizing problem by using the real-time ADI.

4 - Information Reliability in Supply Chains: The Case of Multiple Retailers

Eirini Spiliotopoulou, PhD Candidate in Supply Chain Management, MIT-Zaragoza International Logistics Program, Zaragoza Logistics Center, Zaragoza, 50197, Spain, espiliotopoulou@zlc.edu.es, Mustafa Cagri Gurbuz, Karen Donohue

Multiple retailers consider to form a pooling coalition and delegate inventory management to a benevolent central planner. Each retailer faces uncertain demand and has private information about it due to his proximity to the market. We focus on whether reliable demand information sharing occurs between retailers and the central planner and on the impact of a) the size of the pooling coalition and b) the market uncertainty on the level of trust and trustworthiness of supply chain parties.

5 - Information Sharing in Supply Chain of Durable Goods

Neda Khanjari, PhD Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60202, United States of America, neda@u.northwestern.edu, Seyed Iravani, Hyo duk Shin

We study a supply chain of a durable good product consisted of a retailer with advance demand information and a manufacturer. The retailer and the manufacturer play a pricing game. We study how the policy of the retailer to share his information with the manufacturer depends on durability of the product and other parameters of the model. We find conditions under which the retailer shares information with the manufacturer and study the impact of information sharing on the supply chain profits.

■ SD45

45- North 229 A- CC

Panel Discussion: WORMS: Advice on Promotion to Full from Associate Professor

Sponsor: Women in OR/MS

Sponsored Session

Chair: Mary E. Kurz, Associate Professor, Clemson University, Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, United States of America, MKURZ@clemson.edu

1 - WORMS: Advice on Promotion to Full from Associate Professor Panel

Moderator: Mary E. Kurz, Associate Professor, Clemson University, Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, United States of America, MKURZ@clemson.edu, Panelists: Aleda Roth, Susan Sanchez, Beril Toktay, Julie Higle

In this panel, we will discuss the experiences, observations and receive advice from several successful female faculty housed in different types of departments and institutions, focusing on the transition from associate to full professor.

■ SD46

46- North 229 B- CC

Joint Session ORG/TMS: Organizing for Innovation in the Digitized World

Sponsor: Organization Science & Technology Management

Sponsored Session

Chair: Youngjin Yoo, Temple University, 1810 N. 13th Street, Speakman Hall, Philadelphia, PA, 19122, United States of America, yxy23yoo@gmail.com

1 - Digital Science and Knowledge Boundaries

Deborah Dougherty, Rotgers University, 94 Rockafeller Rd, Janice H. Levin Rm 26, Piscataway, NJ, 08854, United States of America, doughert@business.rutgers.edu

Drug discovery has many unpredictable interdependencies. Science digitalization affords ways to measure, analyze, and model chemical compounds, diseases, and biology.We build on epistemic cultures to develop theory for integrating digital sciences. Digitalization creates essential knowledge and new knowledge boundaries around central activities of innovation. We explain how innovation activities can be transformed to integrate digital science into drug discovery.

2 - Reconfiguring Boundary Relations: Robotic Innovations in Pharmacy Work

Eivor Oborn, Professor, School of Management, Royal Holloway University of London, Egham London, United Kingdom, eivor.oborn@rhul.ac.uk, Wanda Orlikowski, JoAnne Yates, Michael Barrett

We explore the influence of robotic innovations on the boundary dynamics of three different occupational groups and extend conceptually Pickering's tuning approach to examine the entanglement of mechanical elements and digital inscriptions. The robot's hybrid and digital materiality over time reconfigured boundary relations among the three occupational groups with important and contradictory consequences for the pharmacy workers' skills, jurisdictions, status and visibility.

3 - Catalyzing Collaboration Amongst Strangers: Field Experimental Evidence

Karim Lakhani, Assistant Professor, Harvard Business School, Boston, MA, United States of America, k@hbs.edu, Patrick Gaule, Christoph Riedl, Kevin Boudreau, Anita Woolley

We used a field experiment to investigate the emergence of collaboration in 52 groups (5 members) of software developers. We test theoretical predictions from different disciplines – regarding the factors leading to the emergence of collaboration. We find that monetary rewards powerfully shape the effort that workers exert in their work. However, we also find substantial evidence for the existence of peer effects, whereby individuals exert more effort when other team members work harder.

4 - Digital Innovation and the Division of Innovative Labor: Digital Controls in the Automotive Industry

Jaegul Lee, Wayne State University, Detroit, MI, 48202, United States of America, jaegul.lee@wayne.edu

Much of organizational scholarship holds that, accompanying a shift toward modular structures, suppliers tend to engage in invention around the components they supply. In this study, we find that in the wake of a major shift in the digital controls technology, suppliers engage in relatively less component innovation in comparison with their OEMs. By analyzing the evolution of automotive emission control systems, we explain this shift by offering two views about the interfirm division of labor.

■ SD47

47- North 230- CC

Traffic Control Schemes and Applications II

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Qing He, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, qhe@us.ibm.com

1 - Energy-efficient Traffic Management: A Microscopic Simulation-based Approach

Carolina Osorio, Assistant Professor, Massachusetts Institute of Technology, Room 1-232, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, osorioc@mit.edu, Kanchana Nanduri

We use detailed traffic and fuel models to address a fixed-time signal control problem for the Swiss city of Lausanne. We have developed an optimization framework with good short-term performance using a metamodel that combines information from the simulator and an analytical queuing model. The method is able to identify signal plans with improved travel times and energy consumption even under tight computational budgets.

2 - Optimal Speed Trajectory for Fuel Consumption Reduction at Signalized Intersection

Xiaozheng He, University of Minnesota, 500 Pillsbury Dr. SE, Minneapolis, MN, 55414, United States of America, hexxx069@umn.edu, Henry Liu

In this study, we formulate optimal speed trajectories at signalized intersection as solutions to a multi-phase optimal control problem, which considers the impact from vehicle queues due to traffic lights. By applying the pseudospectral method, this multi-phase optimal control problem is reformulated into a nonlinear programming problem which can be solved effectively. We demonstrate the effectiveness of the proposed model by an example.

3 - A Bi-level Formulation for the Combined Dynamic Equilibrium Based Traffic Signal Control

Kien Doan, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, dtkien@gmail.com, Satish Ukkusuri

This paper formulates a combined dynamic signal control optimization (SCO) with dynamic user equilibrium (DUE) using a bi-level formulation. A path-based CTM is embedded as the traffic flow model to capture the different O-D flows at all cells and links and there is no holding-back problem in the entire network. A specialized solution technique will be developed for this problem and rigorously studied to solve general networks. We use a heuristic algorithm based on the projection method to solve the lower level (DUE) problem. A mixed integer programming (MIP) and other extensions are proposed to solve the upper level signal optimization. Extensive numerical results will illustrate the benefits of using this model and algorithm.

4 - Traffic Control Agency Planning and Signal Optimization for Special Planned Events

Qing He, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, qhe@us.ibm.com, Arun Hampapur, Xuan Liu

Large scale special planned events, attracting both high volume of pedestrians and vehicles, result in significant nonrecurrent congestion as well as queue spillover. In this research, we proposed a mixed intersection control model utilizing both manual control from traffic control agency (TCA) and automatic signal control. Different with traffic signals, TCA can effectively balance queues and increase throughput, and prevent intersection capacity drop caused by large volume of pedestrians.

■ SD48

48- North 231 A- CC

Logistics System Planning

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Alan Erera, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30339, United States of America

1 - A Pickup and Delivery Problem using Crossdocks and Truckload Lane Rates

Kathleen Lindsey, Georgia Institute of Technology, Atlanta, GA, United States of America, kate.abercrombie@gatech.edu, Alan Erera, Martin Savelsbergh

A path-based integer programming model is presented for a shipper pickup and delivery planning problem to move freight from origins to destinations. Each shipment is moved either direct via a less-than-truckload (LTL) carrier or consolidated with other shipments and moved by truckload routes. When using a truckload carrier, the shipper takes advantage of contracted lane rates that are significantly less than comparable LTL prices for a full truckload. For larger instances that cannot be directly solved using commercial solvers, an IP-based local search approach is developed.

2 - A Network Flow Methodology to Estimate Empty Trips in Freight Transportation Models

Satish Ukkusuri, Associate Professor, Purdue University, 550 Stadium Mall Drive, G175F, West Lafayette, IN, 47906, United States of America, sukkusur@purdue.edu, Rodrigo Mesa-Arango

This research presents a novel methodology to estimate the number of empty trips useful for regional freight planning. This methodology is based on a time expanded network flow approach that captures behavioral and operational characteristics of the carriers. The model is formulated as a linear optimization problem that minimizes the system costs associated to truck trips. The model is validated with a commercial vehicle survey from Colombia.

3 - Sugarcane Harvest Logistics in Brazil

Kamal Lamsal, University of Iowa, 108 Pappajohn Business Bldg, S210, Iowa City, IA, 52242, United States of America, kamal-lamsal@uiowa.edu, Barrett W. Thomas, Philip Jones

In the face of rising world sugar prices, the logistics of sugar mills in the Brazil, the world's largest sugar producer, are of great interest. In this presentation, we present a rolling horizon approach to coordinating sugarcane harvest operations for Brazilian sugar mills. After each random event, we update an integer program to account for both new information and operations already underway. The solutions from our dynamic approach are compared to a perfect information bound.

4 - Customer Order Rationing in Shipment Consolidation

Benhür Satir, Assistant Professor, Cankaya University, Yenimahalle, Ankara, 06810, Turkey, benhur@cankaya.edu.tr, James Bookbinder, Fatih Safa Erenay

A delivery company faces two classes of demand for dispatching a single package type, viz. standard and express; the latter is more profitable. Shipments are made by capacitated vehicles. The optimal customer rationing policy for shipment consolidation is modeled and solved as a continuous-time Markov Decision Process.

■ SD49

49- North 231 B- CC

Public Transit: Network Modeling

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu

1 - Spatial and Temporal Tradeoffs in Transit Stop Location Problems

Sha Mamun, Graduate Student, University of Conneticut, 261 Glenbrook Road, Unit 2037, Storrs, CT, 06269, United States of America, msm08014@engr.uconn.edu, Nicholas Lownes

A transit network design problem is presented to optimize transit service efficiency by adjusting service frequency and transit stop locations. A bi-level mathematical programming model is constructed to allow tradeoffs between the spatial design (stop location) and the temporal operations (frequency setting). The stop locations are optimized by minimizing the cost components in the lower level, while the upper level optimized the transit line frequencies by maximizing network connectivity.

2 - Trade-offs in Bus Frequency Allocation: System Level Optimization and Application to Large Scale Network

Omer I. Verbas, Northwestern University, Evanston, IL, 60208, United States of America, ismailverbas2012@u.northwestern.edu, Hani S. Mahmassani

We present a system-level model for frequency allocation to bus routes. The formulation solves for optimal frequencies that vary throughout the course of the day on individual routes and associated service patterns. Objectives include ridership maximization, waiting time minimization and cost minimization, subject to fleet and crowding considerations. Detailed demand elasticity levels are used in an application to the Chicago area network.

3 - Equitable Redesign of the Existing Public Transit Route Networks: A Bi-level Optimization Approach

Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu

A bi-level optimization model is formulated, which can explicitly account for the spatial equity, for solving the public transit route network redesign problem (PTNRP). A genetic algorithm based solution approach is developed to solving this PTNRP bi-level optimization model. Network experiments are conducted. Numerical results and related characteristics are also described in detail.

4 - A Simulation-based Transit Assignment Model

Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Alireza Khani

In the context of a scheduled fixed-route transit service, we explore a more realistic passenger assignment using an integrated traffic and transit simulation tool to generate transit vehicle trajectories. Using these trajectories, we assign transit passengers to the network using either a trip-based shortest path or a trip-based hyperpath assignment. The simulation model and the associated transit assignment methods are illustrated on a case study from Sacramento, California.

■ SD50

50- North 231 C- CC

Military Search and Surveillance

Sponsor: Military Applications

Sponsored Session

Chair: Michael Hirsch, Raytheon Company, Orlando, FL, United States of America, mjh8787@ufl.edu

1 - Hunting Drug Smugglers: An Optimal Search Problem in Continuous Time and Space

Jesse Pietz, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, japietz@nps.edu, Johannes Royset

We consider search for moving targets in continuous time and space, and formulate a mixed-integer nonlinear program whose solution yields an optimal search plan. We highlight features of this highly challenging problem that lead to specialized algorithms and discuss solutions for application to drug smuggling interdiction operations.

2 - Optimal Search for a Random Moving Intruder

David Casbeer, Air Force Research Lab., AFRL/RBCA, B146 R300, WPAFB, OH, 45433, United States of America, David.Casbeer@wpafb.af.mil, Meir Pachter, K. Krishnamoorthy, Phillip Chandler

Using reachability arguments, the optimal control of an agent searching for an intruder on a graph is considered. The agent is only able to perceive partial and delayed information about the intruder. Sufficient conditions for guaranteed isolation of the intruder, before he reaches his goal, and the corresponding optimal agent control policy, are provided.

3 - A Joint Surveillance and Patrol Problem for Law Enforcement

Belleh Fontem, PhD Candidate, The University of Alabama, 300 Alston Hall, 361 Stadium Drive, Tuscaloosa, AL, 35487, United States of America, bafontem@crimson.ua.edu, Sharif Melouk, Burcu Keskin

We investigate the problem of using unmanned aerial systems (UASs) as visual aids to ground law enforcement agents while assigning dangerous incidents to these agents in order to maximize the cumulative harm averted to society. We introduce a very tight formulation of the resulting team orienteering problem and and draw insights from theoretical analyses as well as from numerical experiments.

■ SD51

51- North 232 A- CC

Joint Session MAS/SPPSN:Defense Operations and Homeland Security II

Sponsor: Military Applications & Public Programs, Service and Needs

Sponsored Session

Chair: Anna Doro-on, Sr. Consultant/Project Engineer, Water, Tunnel & Infrastructure Concepts, Inc., 120 S. Euclid Avenue, Pasadena, CA, 91101, United States of America, anna@annaforhomelandsecurity.com

1 - Terror Queues and the Duration of Terror Plots

Edward Kaplan, William N. and Marie A. Beach Professor of Management Sciences, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, edward.kaplan@yale.edu

Starting with a review of US terrorism-related indictments, lower and upper bounds for the initiation date of 30 distinct Jihadi plots were identified in addition to the date of arrest or an attempted/actual terror act. Estimated mean duration equals 9 months, while 95% of all plots are estimated to fall between 1 and 25 months. These estimates suggest that in the United States, on average approximately three ongoing Jihadi terror plots have been active at any point in time since 9/11/2001.

2 - Intelligent-IEDs Application and Risk Acceptability Optimization in a Successful Conduct of War

Anna Doro-on, Sr. Consultant/Project Engineer, Water, Tunnel & Infrastructure Concepts, Inc., 120 S. Euclid Avenue, Pasadena, CA, 91101, United States of America, anna@annaforhomelandsecurity.com

The Improvised Explosive Devices (IEDs) were used by terrorists against United States and Allies' military forces and responsible of deaths in Iraq and Afghanistan. This paper presents the application of intelligent-IEDs for the effectiveness of military operations and defense against the enemy, to decrease military casualties, protect infrastructures, minimize risk of terrorism, and maximize risk acceptability.

3 - Finding Fakes: Counterfeit Product Detection at United States Border Crossings

Gregory DeYong, Assistant Professor, University of Michigan-Flint, 2145 Riverfront Center, 303 E. Kearsley Street, Flint, MI, 48502, United States of America, gdeyong@umflint.edu

The problem of counterfeit products continues to plague manufacturers. Using data from the U.S. Customs and Border Patrol, we analyze the effectiveness of border crossing points using data envelopment analysis and apply game theory to suggest interdiction strategies.

4 - Optimal Placement of Multiple Types of Detectors under a Small Vessel Attack Threat to Port Security

Xiaofeng Nie, Assistant Professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798, Singapore, xiaofengnie@ntu.edu.sg, Xihong Yan

Because of the strategic importance, ports are potential terrorist targets. We focus on the threat scenario where the terrorists would use small vessels as waterborne improvised explosive devices to attack maritime targets. We consider how to locate multiple types of detectors such that the expected damage cost is minimized. The model is formulated as a nonlinear binary integer program and some exact and heuristic algorithms are proposed.

■ SD52

52- North 232 B- CC

Optimization in Smart Grid

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Andrew Liu, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu

1 - Decision Making in the Operation of Smart Distribution Systems

Mingguo Hong, Midwest ISO, 5407 Alvamar Place, Carmel, IN, 46033, United States of America, mingguoh@hotmail.com

The Smart Grid operation involves both the eletrical transmission and distribution systems where infrastructure and operational strategy changes should take place in parallel. This talk focuses on the operational decisions of the Smart Grid at the distribution system level to ensure greater grid reliability and economic efficiency. The talk also looks at a potential market design for the distribution system involving electrical utility and their customers.

2 - Quantify Effects of Home Energy Management System under Dynamic Electricity Pricing

Jingjie Xiao, PhD Candidate, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, jingjie.xiao@gmail.com, Andrew Liu, Joseph F. Pekny

A key hurdle for implementing real-time pricing of electricity is the lack of consumers' responses. Solutions to overcome the hurdle include energy management systems that can automatically optimize household appliance usage and PHEV charging via two-way communication with the utilities (or the grid). This talk will show how the optimization can be done and how such systems can be integrated with electricity markets' operation under various uncertainties through approximate dynamic programming.

3 - SMART-ISO: A Stochastic, Multiscale Model of the PJM Power Grid

Warren Powell, Princeton University, 230 Sherrerd Hall, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Boris Defourny, Hugo Simao

We will describe the development of a stochastic, multiscale, dynamic model of the PJM power grid. SMART-ISO includes a full model of the PJM power grid, a robust day-ahead model for stochastic unit commitment, hour-ahead modeling for planning natural gas simulation, and economic dispatch solved at five minute increments for accurate modeling of ramp rates of natural gas units and variations in renewables. We report on the status of this multi-year development effort.

4 - Dynamic Stability of Electricity Markets

Victor Zavala, Argonne National Laboratory, Mathematics & Computer Science Division, Chicago, IL, 60439, United States of America, vzavala@mcs.anl.gov

We present new insights on the dynamic stability of markets. We discuss how stability issues arise from incomplete gaming and physical constraints and propose strategies to mitigate these.

■ SD53

53- North 232 C- CC

Optimization Models for Demand-Response

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Miguel F. Anjos, Canada Research Chair in Discrete Nonlinear Optimization in Engineering, Ecole Polytechnique de Montreal, C.P. 6079, succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, miguel-f.anjos@polymtl.ca

1 - Real-time Demand Response Model

Antonio Conejo, Professor, Universidad Castilla-La Mancha, Campus Universitario, Ciudad Real, 13071, Spain, Antonio.Conejo@uclm.es, Luis Baringo, Juan Miguel Morales

This presentation describes an optimization model to adjust the hourly load level of a given consumer in response to electricity prices. The objective of the model is to maximize the consumer utility. Price uncertainty is modeled through robust optimization techniques. The model materializes into a simple LP that can be integrated in the Energy Management System of a household or a small business. A simple bi-directional communication device enables the implementation of the proposed model.

2 - Demand Response in the California ISO market

Guillermo Bautista Alderete, Manager of Market Validation and Quality Analysis, California ISO, 250 Outcropping Way, Folsom, CA, 95630, United States of America, bautista.guillermo@gmail.com

This presentation explains the initiatives and mechanisms in place to facilitate the participation of retail demand response programs in the California ISO wholesale market, including the implementation of a new demand response product known as the proxy demand resource. In conjunction with the ISO's existing participating load product, the proxy demand resource product will add to the demand response capability available to market participants.

3 - Optimization for Time-of-use Control in Electricity Demand Side Management

David F. Rogers, Associate Professor of Operations and Business Analytics, University of Cincinnati, 2925 Campus Green Dr, 531 Carl H. Lindner Hall, Cincinnati, OH, 45221-0130, United States of America, David.Rogers@UC.edu, George G. Polak

Time-of-use pricing of electricity in demand side management requires determining the time periods of a day that should be grouped for identical pricing. Integer & constraint programming models to find clusters of contiguous periods potentially with a "wrap-around" feature for which time periods at both the beginning and end of the day may be in the same cluster are examined. A real-world data set consisting of kwh usage for 93 buildings was employed for testing the models.

4 - A System Architecture for Autonomous Demand Side Load Management in Smart Buildings

Miguel F. Anjos, Canada Research Chair in Discrete Nonlinear Optimization in Engineering, Ecole Polytechnique de Montreal, C.P. 6079, succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, miguel-f.anjos@polymtl.ca, Giuseppe T Costanzo, Gilles Savard, Guchuan Zhu

We present a new system architecture for demand-side load management. The system is composed of modules for admission control, load balancing, and demand/response management that operate using online operation control, optimal scheduling, and dynamic pricing respectively. It can integrate different energy sources and handle autonomous systems with heterogeneous dynamics in multiple time-scales. Simulation results confirm the viability and efficiency of the proposed framework.

ENRE Poster Session

North Building Foyer

Cluster: ENRE Poster

Invited Session

Chair: Juan Pablo Vielma, University of Pittsburgh, 1043 Benedum Hall, 3700 O'Hare Street, Pittsburgh, PA, 15261, United States of America, jvielma@pitt.edu

1 - Competitive Markov Decision Process Model for Energy-water-climate Change Nexus

Ivan Savedra, Research Assistant, University of Wisconsin-Milwaukee, 3200 North Cramer Street, Milwauke WI 53211, United States of America, saavedr9@uwm.edu,Vishnuteja Nanduri

Drought-like conditions brought on by climate change are causing water shortages leading to power disruptions in many regions in the world. It is noted by the DOE that U.S. electricity industry uses more water for electricity production than the entire agricultural and horticultural industries combined. Energy-water-climate change nexus is a critical issue that needs to be addressed. However, there are no existing quantitative models that examine this nexus. Our paper addresses this challenge.

2 - Investigating through the Effects of Renewable Energy Technologies Exploitation on Economic Growth

Seyed Hadi Nourbakhsh, University of Tehran, No 370, 66 Alley, Dardash St.,Narmak, Tehran, Iran, hadi.noorbakhsh@gmail.com, Setareh Ariafar, Hessam Kazari

In this research we tried to survey the effect of utilizing renewable energy technologies in electricity generation on economic growth by benefiting from a system dynamics approach. At first, we designed a causal model with considering main exogenous energy systems variables and economic variables. Then we executed proposed model for the case of Iran.

3 - Modeling Investment Planning in Thermal Power Generation in India using Optimal Control Methods

Sudhakar Achath, Professor, Amrita School of Business, Amrita Vishwa Vidyapeetham, Coimbatore, TN, 641112, India, s.m.achath@gmail.com

Using linear quadratic control with learning, this study formulates an optimal plan for investments in plant capacity, R&D expenditure and imported technology for the Indian thermal power sector. The modelling system has twelve linear equations and the control problem formulated in state-space is solved as a dynamic programming problem using Lagrange multipliers and a backward solution method, following Chow (1975). The problem was initially written in BASIC but later resolved in open-source R.

4 - Multi-objective Retrospective Optimization using Zigzag Search

Honggang Wang, Rutgers University, 212 CoRE Building, Busch Campus, Rutgers, Piscataway, NJ, 08854, United States of America, honggang.w@rutgers.edu

We propose a new retrospective optimization (RO) method with a gradient-based zigzag search approach for multi-objective simulation optimization (MOSO)problems. In the context of MOSO, a stochastic zigzag search algorithm is used in the RO framework. Numerical results of applying this new algorithm to MOSO problems will be provided.

5 - Optimization for Annual Unloading Arrangement and Inventory Management in LNG Receiving Terminals

Hidetaka Shinozaki, Tokyo Gas Co.,Ltd., 5-20, Kaigan 1-Chome, Minato-Ku, Tokyo, 1058527, Japan, shinozaki@tokyo-gas.co.jp, Shinnosuke Kimura, Hiroshi Kashio, Yohei Nakai, Mariko Ito, Shirou Morimitsu, Kazuaki Nagai

We receive over 300 LNG vessels annually. The operators not only allocate the vessels to 3 terminals but also manage the inventory of 52 LNG tanks considering many constraints related to stocks, calorific values and so on. Besides, we have to reschedule the plan whenever some changes by shipping delay or demand fluctuations occur. We optimized annual unloading arrangement and inventory management in LNG receiving terminals. It enables to reduce the manpower and the operating cost.

6 - Optimizing Batteries in Electricity Markets

Eugene Zak, Viridity Energy, 2370 130 Ave., NE, #104, Bellevue, WA, United States of America, ezak@viridityenergy.com, Ricardo Rios-Zalapa

Battery can operate as a generator, load, or storage. The problem is how to integrate the battery into the grid given its life cycle characteristics, functional flexibility, and electricity market conditions. We propose a model to optimize battery use for energy and regulation. The model takes advantage of a price difference between distinct time periods and alternative products and services. As a result the model delivers a charge-discharge strategy and its impact on the battery life.

7 - Payment Uncertainty Management in a Combined Market of Energy and Reserve

Taísa Felix, Instituto Federal de Brasília, Quadra SHCGN 703 Bloco L, Apartamento 103, Brasilia, DF, 70730-712, Brazil, taisa.felix@ifb.edu.br, Pablo Cuervo

As a rule, power system markets operate considering bid cost minimization (BCM) in clearing processes. This procedure has inconsistency because the total BCM is different from the load payment. This work introduce a combined market model of energy and reserve operating under Payment Minimization (PM), transforming the problem in a bi-level linear model, which can be solved using GAMS®. Expected payment is evaluated using Monte Carlo simulation, providing results to evaluate the PM energy policy.

8 - Transmission Expansion Planning using a Linearized AC Model

Hui Zhang, Arizona State University, 5th floor, Room 519, 551 E. Tyler Mall, Tempe, AZ, 85281, United States of America, dahui911@hotmail.com, Vijay Vittal, Gerald Heydt

This paper presents a MILP approach for solving transmission expansion planning (TEP) problems using a linearized AC model. Compared to existing DC-based TEP models, the proposed model includes reactive power, off-nominal bus voltage magnitudes as well as network losses. A practical approach to include the N – 1 criterion is also discussed. The simulation results show that the proposed TEP model has better accuracy and is applicable to solve TEP problems for large power systems.

■ SD54

54- Regency Ballroom A- Hyatt

Feature Articles from Recent Issues of INFORMS Transactions on Education (ITE) and Discussion of the ITE Review & Publication Process

Cluster: INFORMS Journals Cluster

Invited Session

Chair: James Cochran, Bank of Ruston Endowed Research Professor, Louisiana Tech University, College of Business, Ruston, 71272318 2, United States of America, jcochran@latech.edu

Co-Chair: Matthew Bailey, Associate Professor, Bucknell University, School of Management, Lewisburg, PA, 17837, United States of America, matt.bailey@bucknell.edu

Co-Chair: Vijay Mehrotra, University of San Francisco, School of Management, 2130 Fulton Street, San Francisco, CA, United States of America, vmehrotra@usfca.edu

Co-Chair: Armann Ingolfsson, Dr., University of Alberta, School of Business, University of Alberta, Edmonton, AB, T6G 2R6, Canada, armann.ingolfsson@business.ualberta.ca

Co-Chair: Jill Hardin Wilson, Northwestern University IEMS, 2145 Sheridan Rd, Room C210, Evanston, IL, 60208, United States of America, jill.wilson@northwestern.edu

1 - The Effectiveness of using a Web-based Applet to Teach Concepts of Linear Programming

Christine Kydd, Professor, University of Delaware, Department of Business Administration, Lerner College of Business, Newark, DE, 19716, United States of America, chriskyd@udel.edu

This paper presents a web-based java applet that was used by instructors and students to graphically illustrate/learn fundamental concepts of LP models. It describes the results of a study which compares student performance of those who did use the applet vs. those who did not. Results show that the students who used the applet to learn about LP concepts performed significantly better than those who did not. Implications for using such techniques in the classroom are discussed.

2 - Active Learning Exercises for a Service Operations Management Course

Mark Davis, Professor, Bentley University, 175 Forest St., Waltham, MA, 02452, United States of America, mdavis@bentley.edu, Ravi Behara

In today's hi-tech environment, students are familiar with the Internet where they actively participate in the generation and consumption of information. Thus, if business schools want to stimulate student interest, they have to actively engage them in the learning process. This presentation introduces exercises, some of which are part of the course structure, that incorporate active learning in the classroom, and which align well with topics that are in a service operations management course.

3 - Case Article: Flight Delays at RegionEx

Susan Martonosi, Harvey Mudd College, Department of Mathematics, Claremont, CA, United States of America, martonosi@hmc.edu, Amr Farahat

In this case about two fictitious airlines, RegionEx, a small regional airline, is a contracted regional carrier for MDA, a major US airline. RegionEx is at risk of losing its contract due to an apparently poor flight delay record, and the Flight Operations Manager must analyze the flight delay records and explain RegionEx's seemingly poor performance. Undergraduate and MBA students use basic data analysis techniques to discover important paradoxes in the flight delay data.

4 - KEY Electronics - Sourcing and Warehouse Analysis

Tim Kraft, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States of America, kraftt@darden.virginia.edu, Yenho Chung, Feryal Erhun

KEY Electronics is a consumer electronics retailer that generated $1.4 billion in total revenue in 2008. KEY has a limited retail presence in Mexico, which it would like to expand. As part of its growth strategy, KEY must (1) improve its current sourcing of products for Mexico and (2) revamp its existing warehouse operations. KEY introduces students to a practical inventory modeling scenario with real-life data, where solutions are not solely based on minimum cost but also qualitative factors.

■ SD55

55- Regency Ballroom B - Hyatt

Operations Research and†Management Science in Emerging Economies

Cluster: Operations Research in Emerging Economies

Invited Session

Chair: Siddhartha SenGupta, Principal Scientist, Tata Consultancy Services Ltd, Gateway Park, 2nd flr, MIDC Road 13, MIDC, Andheri East, Mumbai, Ma, 400093, India, Siddhartha.SenGupta@tcs.com

1 - Rationing Policy and Inventory Optimization Models for a Three-Stage Divergent Supply Chain

Chandrasekharan Rajendran, Professor, IIT Madras, Chennai, 600 036, India, craj@iitm.ac.in, Kurian John, Brijesh Paul

This work considers a static three-stage divergent supply chain model consisting of retailers, two distributors and one manufacturer. A distributor serves only a subset of retailers for whom she/he is the sole supplier. The unsatisfied demands at all the installations are backordered. Assuming the base-stock policy, the objective is to determine the best installation inventory order policy parameters such as the base-stock levels and inventory rationing quantities, with the objective of minimizing the total supply chain cost (TSCC) consisting of holding costs and shortage costs at all installations in the supply chain over a finite planning horizon. An integer programming model to determine the optimal inventory control-policy parameters is proposed in this work. Computational complexity limits the applicability of the exact solution method to large problem sizes. Therefore, in the current study we also propose a hybrid heuristic technique based on Genetic Algorithm (GA) and Particle Swarm optimization (PSO) algorithm to determine the best base-stock levels. A heuristic rationing rule determines the shipment (rationing) quantity in the case of shortage at a higher installation, while meeting the customer demands. The performance of the hybrid heuristic against the stand-alone GA and PSO is ascertained by testing the algorithms under various supply chain settings.

2 - A Rough Set-decision Tree Based Approach for Design of Optimal Process Tolerances

J Maiti, Associate Professor, Indian Institute of Technology Kharagpur, Industrial Engineering and Management, Kharagpur, India, jmaiti@iem.iitkgp.ernet.in, Sandipan Karmakar

Tolerance design provides a leeway to counteract the inherent manufacturing uncertainties with desired product performance. It is important to design tolerances on process elements based on product dimensions. In this study, the authors propose a novel approach using rough set theory-decision tree to find out the best tolerance values on process elements. A example of an assembly of sheet metals for automotive body assembly is discussed to show the effectiveness of the proposed method.

3 - Business Models and Processes for 3PL Providers
Siddhartha SenGupta, Principal Scientist, Tata Consultancy Services Ltd, Gateway Park, 2nd flr, MIDC Road 13, MIDC, Andheri East, Mumbai, Ma, 400093, India, Siddhartha.SenGupta@tcs.com

Economically Services are becoming increasingly more important and it would be useful to develop appropriate Business Models and Business Processes for service value chains. Here we try to "Learn from the smokestacks" - from the well developed Models and Processes of Manufacturing. In particular, we find that the IHIP characteristics of Services make them similar to manufacturing models where the decoupling point is away from the customer processes, e.g. in Make-To-Order. We adapt and extend the relevant methods of these models to 3PL services, especially to shipping.

4 - Food Security for Emerging Economies – An OR Perspective
G Raghuram, Professor, Indian Institute of Management Ahmedabad, Wing 15, IIMA Campus, IIMA Campus, Ahmedabad, 380015, India, graghu@iimahd.ernet.in, Ankan Pal

Food security is provided by the Food Corporation of India which procured 50 million tons of food grains in 2011-12 with a spend of over Rs 80,000 crores. Towards achieving this, the primary activity is managing logistics, including the type of storage (bulk/bagged, covered/open, own/outsourced), allocation from procurement to storage to demand points, mode choice, and quality management. This paper provides a perspective on OR methods which can help achieve food security while optimizing costs.

■ SD56

56- Curtis A- Hyatt

Entrepreneurship and Innovation II

Sponsor: Technology Management

Sponsored Session

Chair: Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest Park, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu

1 - Strategies for Profiting from Technologies with Weak Patent Rights
Leonardo Santiago, Federal University of Minas Gerais, Escola de Engenharia da UFMG, Av. Antonio Carlos, 6627. Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Henrique Rocha

We investigate a set of strategies that companies adopt in order to profit from innovations. The strategies depend not only on inherent features of the innovation at stake but also on the incentives potential competitors have to enter in the target market. Our main focus is on technologies characterized by weak patent rights.

2 - Management of Innovation in the Product and Technology Markets
Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest Park, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu, Karthik Ramachandran

Firms in many technology intensive industries increasingly license innovations to potential competitors besides using them in their own products. Licensing not only creates an additional profit stream, but could also enhance the value of the innovator's own product. However, it also makes the licensee a potent competitor in the product market. In this paper, we develop a model to understand if, when and how a firm should share its innovation with a rival.

3 - Value of Reverse Factoring in Multi-stage Supply Chains
Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl, Hande Cetinay, Matthew Reindorp

We develop a mathematical model for integration, analysis, and optimization of operational and financial processes within a supply chain. Specifically, we consider commercial transactions of a large corporate customer with a small- or medium-sized supplier. We show how application of reverse factoring – an increasingly popular product within the broad field of supply chain finance – influences the operational and financial decisions of these firms.

4 - A Dynamic Model of Knowledge Creation from Exploration and Exploitation in the High-tech Venture
Jennifer Bailey, Georgia Institute of Technology, 800 W. Peachtree Road, NW, Atlanta, GA, United States of America, Jennifer.Bailey@mgt.gatech.edu, Cheryl Gaimon

We develop a dynamic model of exploration and exploitation for a high-tech venture. The uncertain nature of these learning activities is captured in terms of the mean and variance of the innovation outcomes. We consider the impact of the venture's absorptive capacity as well as the lagged effect of exploration on innovation outcomes. We determine when the typical explore-exploit versus an atypical exploit-explore sequential strategy is optimal.

■ SD57

57- Curtis B- Hyatt

Applications of Queueing Models

Contributed Session

Chair: Jun Luo, Hong Kong University of Science and Technology, Rm 5567, Academic Building, Clear Water Bay, Hong Kong, Hong Kong - PRC, jluolawren@ust.hk

1 - Modeling Sequential Zone Picking Systems
Jelmer van der Gaast, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, jgaast@rsm.nl, René De Koster, Ivo Adan, Jacques Resing

We develop an analytical model for analyzing sequential zone picking systems. The system is approximated by a multi-class product-form closed queueing network with jump-over blocking. An iterative algorithm using mean value analysis (MVA) is used to evaluate the performance statistics of the order picking system. The accuracy of the algorithm is compared with this results of a discrete event simulation.

2 - A Simple, Practical Prioritization Scheme to Minimize Cycle Time and Maximize Throughput
Shuping Zhang, University of Tennessee, Knoxville, 201 Stokely Management Center, Knoxville, TN, 37996, United States of America, szhang12@utk.edu

The MRO process is used to recondition equipment in the railroad, off-shore drilling, aircraft, and shipping industries. We model the back-shop as a multi-class queueing network with a ConWIP execution system and introduce a new priority scheme to maximize system performance. Simulation results show that this priority scheme increases system performance by lowering average cycle times without dramatically impacting total throughput.

3 - Optimal Staffing for Ticket Queues
Li Xiao, Business School, National University of Singapore, Biz 2 Building, Basement B2-03, NUS, singapore, Singapore, a0075548@nus.edu.sg, Susan Xu, Hanqin Zhang

This talk is concerned with ticket queues systems, where each arriving customer gets in the system with a numbered ticket and observes the number of working servers. The arriving customers abandon the system with some probability determined by the number of working servers. The system cost includes customer abandonment and server operations costs. Based on the ticket number information, we address the question how to staff such that the expected long-run average cost is minimized.

4 - Staffing and Control of an Instant-messaging Based Customer Service Center
Jun Luo, Hong Kong University of Science and Technology, Rm 5567, Academic Building, Clear Water Bay, Hong Kong, Hong Kong-PRC, jluolawren@ust.hk, Jiheng Zhang

A new kind of customer service centers, in which agents communicate with customers via instant-messaging (IM) on the Internet, is prevalent nowadays. A distinctive feature of IM-based service centers is that one agent can serve multiple customers in parallel. We model it as a server pool consisting of many limited processor sharing servers. The underlying stochastic processes can be characterized by a fluid approximation, which provides insights into the optimal staffing and control policies.

■ SD58

58- Phoenix East- Hyatt

Asymptotics and Optimization of Queueing Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Hengqing Ye, Associate Professor, Hong Kong Polytechnic University, Kowloon, Hong Kong - PRC, lgtyehq@inet.polyu.edu.hk

1 - Excursion-based Universal Approximations for the Erlang-A Queue in Steady-state

Itai Gurvich, Northwestern University-Kellogg School of Management, Evanston, IL, United States of America, i-gurvich@kellogg.northwestern.edu, Junfei Huang, Avishai Mandelbaum

We re-visit the Erlang-A queue and propose a universal diffusion approximation (rather than limit) that applies simultaneously to all of the existing many-server heavy-traffic regimes: QED, ED, QD and NDS. The approximation yields accurate estimates for steady-state metrics. In our proofs, we do not use the steady-state distribution of the Erlang-A queue. Rather, we relate the excursions of the underlying Birth-and-Death process to properly defined excursions of the universal diffusion.

2 - Optimal Queue-size Scaling in Switched Networks

Neil Walton, University of Amsterdam, Science Park 904, Amsterdam, 1098 XH, Netherlands, n.s.walton@uva.nl, Yuan Zhong, Devavrat Shah

We consider a switched network with constraints on which queues may be served simultaneously; such networks have been used to effectively model input-queued switches. The scheduling policy for such a network specifies which queues to serve at any point in time, based on the current state or past history of the system. We provide a new class of online scheduling policies that achieve optimal average queue-size scaling for a class of switched networks including input-queued switches.

3 - Diffusion Limit of Fair Resource Control—Stationarity and Interchange of Limits

Hengqing Ye, Associate Professor, Hong Kong Polytechnic University, Kowloon, Hong Kong-PRC, lgtyehq@inet.polyu.edu.hk, David Yao

Consider a network in which each job requires the concurrent occupancy of a subset of servers, and the service capacity is shared among job classes following the proportional fair allocation. We demonstrate that the usual traffic condition of the diffusion limit is necessary and sufficient for both the diffusion limit and prelimit networks to have stationary distributions, and justify the diffusion approximation of the stationary distribution and p-th moment under a bounded workload condition.

4 - Skill Based FCFS Service Systems

Gideon Weiss, University of Haifa, Mount Carmel 31905, Haifa, Israel, gweiss@stat.haifa.ac.il, Ivo Adan

We consider systems with several types of customers and several types of servers, where compatibility of servers to customers is given by a bipartite graph. This is motivated by call centers with skill based routing, and by organ transplant applications. A common approach is provided by infinite first come first served matching of two infinite multi-type random sequences. We obtain explicit results for this model, and approximations for many server queues with abandonments.

■ SD59

59- Phoenix West- Hyatt

Stochastic Network Algorithms

Sponsor: Applied Probability

Sponsored Session

Chair: Devavrat Shah, Massachusetts Institute of Technology, 32-D670, 77 Massachusetts Ave, Cambridge, MA, 02139, United States of America, devavrat@mit.edu

Chair: Yuan Zhong, Massachusetts Institute of Technology, 235 Albany Street, Cambridge, MA, 02139, United States of America, zhyu4118@mit.edu

1 - Dynamic Scheduling in Queueing Networks with Heavy-tailed Traffic: Insights through Fluid Models

Mihalis Markakis, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32D-666, Cambridge, MA, 02139, United States of America, mihalis@mit.edu, John N. Tsitsiklis, Eytan Modiano

In this talk we present the first steps towards a systematic methodology for evaluating the performance of dynamic scheduling policies for switched queueing networks under heavy-tailed traffic. We establish a connection between delay instability of queues and the evolution of the fluid model from certain initial conditions. This enables us to identify the delay unstable queues by simulating the fluid model. Moreover, it allows us to reach a surprising conclusion for special networks of interest.

2 - A Note on Queue-size Scaling for Input-queued Switches

Yuan Zhong, Massachusetts Institute of Technology, 235 Albany Street, Cambridge, MA, 02139, United States of America, zhyu4118@mit.edu, Devavrat Shah, John N. Tsitsiklis

We consider queue-size scaling in an input-queued switch. In the main result of the paper, we provide a new class of scheduling policies under which the long-run average total queue size scales as power 2.5 of the port number n, in a certain limiting regime of interest. This is a substantial improvement upon prior works, where the same quantity scales as power 3 of n. Our result also advances toward a conjecture about optimal queue-size scaling in input-queued switches.

3 - Smoothed Online Convex Optimization

Adam Wierman, Assistant Professor, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, adamw@caltech.edu, Lachlan Andrew, Minghong Lin, Alan Roytman

Out work on sustainable data center design during the last few years has repeatedly led us to a class of problems we term "smoothed online convex optimization (SOCO)" problems. SOCO is a variant of the class of "online convex optimization (OCO)" problems, and is strongly related to the class of "metrical task systems", each of which have been studied largely independently. In this talk I will discuss some recent progress toward unifying the results and algorithms from these communities.

4 - The UFOS Algorithm for Network Resource Allocation

Yang Yang, Graduate School of Business, Stanford University, W146A, Knight Management Center, 655 Knight Way, Stanford, CA, 94305, United States of America, yang.yang1025@stanford.edu, J. Michael Harrison, Chinmoy Mandayam

The UFOS algorithm (utilization first, output second) puts primary emphasis on greedy maximization of total resource utilization, and secondary emphasis on greedy maximization of total outflow. Focusing on connection-level models of internet congestion control, we compare the delay-related performance of UFOS with that of proportionally fair (PF) resource allocation. In our simulation studies, UFOS reduces overall average delay by about 30% relative to PF.

■ SD60

60- Remington- Hyatt

Air Transportation and High-Speed Rail: Competition and Cooperation

Sponsor: Aviation Applications

Sponsored Session

Chair: Regina Clewlow, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rclewlow@alum.mit.edu

1 - The Impact of Climate Policy on U.S. Aviation and High-speed Rail

Regina Clewlow, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rclewlow@alum.mit.edu, Joseph Sussman

In this study, we examine the energy and CO2 emission impacts of aviation and potential high-speed rail in major short-haul intercity corridors in the United States. We couple a simulation model of high-speed rail and aviation demand with a general equilibrium model that examines the impact of climate policy on the U.S. on a regional scale. We will present the modeling methodology, as well as the results of economic and emissions analyses for several policy scenarios.

2 - Long-term, System-wide Impact Analysis of High-speed Rail in the Midwest Corridor

Jeffrey Peters, Purdue University-Nextrans, 3000 Kent Ave., West Lafayette, IN, 47906, United States of America, peters83@purdue.edu, En-Pei Han, Daniel DeLaurentis, Srinivas Peeta

This study describes a methodology for forecasting system-wide ridership and the corresponding user and community impacts of a high-speed rail mode under the existing transportation infrastructure. Experiments with various social, economic, technological, and political trends over the next few decades are conducted using the proposed Chicago-Hub network to analyze the potential viability in the long-term. Both the methodology and the impacts of the proposed system will be discussed.

3 - HSR: Paying Our Way Forward
Nicolas Norboge, Assistant Transportation Researcher, Texas Transportation Institute, 3135 TAMU, Room 334, College Station, TX, 77840, United States of America, n-norboge@ttimail.tamu.edu

With renewed interest in intercity passenger rail brings the emergence of fresh efforts to develop comprehensive system plans. However, many plans fail to explain clearly how such capital-intensive projects will be paid for. This research provides a list of viable funding and financing strategies transportation professionals and policymakers to consider for paying for new HSR networks.

■ SD61

61- Russell- Hyatt

AAS Dissertation Prize / Anna Valicek Medal

Sponsor: Aviation Applications

Sponsored Session

Chair: Laurie Garrow, Associate Professor, Georgia Institute of Technology, School of Civil Engineering, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu

1 - Building Reliable Air-travel Infrastructure using Empirical Data and Stochastic Models
Mazhar Arikan, University of Kansas, School of Business, Lawrence, KS, United States of America, mazhar@ku.edu, Milind Sohoni, Vinayak Deshpande

Flight delays have been a growing issue and they have reached an all time high in recent years. We develop stochastic models, using empirical data, to analyze the propagation of delays through air-transportation networks. We then analyze robustness measures for airline networks. Our analysis enables us to make policy recommendations regarding managing bottleneck resources in the air-travel infrastructure, which if addressed, could lead to a significant improvement in air-travel reliability.

2 - The Recoverable Robust Tail Assignment Problem
Stephen Maher, University of New South Wales, School of Mathematics and Statistics, Sydney, 2052, Australia, stephen.maher@unsw.edu.au, Gary Froyland, Cheng-Lung Wu

Disruptions affect airline operations, resulting in increased operational costs. Robust planning attempts to reduce the impact of these disruptions. We develop a less conservative robust plan using the concept of recoverable robustness for the tail assignment problem. Simultaneously solving the tail assignment planning and recovery problems to integrate recovery decisions into the original plan. Resulting in a tail assignment that is recoverable with a minimal number of operational changes.

3 - Methods for Improving Robustness and Recovery in Aviation Planning
Marcial Lapp, US Airways, Phoenix AZ, United States of America, mlapp@gmail.com

Flight disruptions can have major effects on scheduled aircraft maintenance events. Once aircraft rotations are disrupted, plans must be updated to comply with regulations for aircraft maintenance. We address this issue by providing pre- and post-disruption strategies to stay compliant with regulations through our maintenance planning and recovery framework. We present results that illustrate the effectiveness of our optimization strategy and its impact on an airline's short-term maintenance planning process.

■ SD62

62- Borein A- Hyatt

Combinatorial Markets

Cluster: Auctions

Invited Session

Chair: Ben Lubin, Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States of America, blubin@bu.edu

1 - Algorithms for Finding Bayes-Nash Equilibria in Core-selecting Auctions
Mark Schneider, University of Connecticut, Uconn School of Business, 81 Cheney Drive, Storrs, CT, United States of America, mschneider@business.uconn.edu, Robert Day

Determining Bayes-Nash equilibria in combinatorial auctions is quite difficult, and to date, the analytical approach to finding an exact equilibrium has been successful only in very limited settings. In this work, we explore the alternative possibility of approximating equilibrium behavior using numerical methods, with a focus on the class of core-selecting auctions.

2 - New Payment Rules in Core-selecting Auctions
Marissa Beck, Stanford University, 579 Serra Mall, Stanford, CA, 94305, United States of America, mrbeck@stanford.edu, Robert Day

The set of core-selecting auctions is large and previous literature has focused mostly on minimum-revenue core-selecting auctions. We explore alternative "core" pricing rules based on linear item prices and LP duality, but enforcing stricter competitive equilibrium properties. A primal-dual cutting-planes approach is used to strike a balance between the (sometimes infeasible) concept of item prices and the (always obtainable but less intuitive) concept of personalized package prices in the core.

3 - Coordination in Combinatorial Auctions with Unknown Bundles
Zhen Hao, Technical University Munich, Boltzmannstr 3, Garching, Germany, hao@in.tum.de, Martin Bichler

One of the main strategic challenges in combinatorial auctions is the coordination problem of bidders when they do not know the bundles, which are of interest to other bidders. We propose a combinatorial auction format, in which we leverage information on losing coalitions, which is collected by the auctioneer. We analyze how bidders respond to different levels of information feedback and overall efficiency compared to the combinatorial clock auction.

4 - Payment Rules through Discriminant-based Classifers
Ben Lubin, Professor, Boston University, 595 Commonwealth Avenue, Boston, MA, 02215, United States of America, blubin@bu.edu, Felix Fischer, Pichayut Jirapinyo, John Lai, Paul Deutting, David Parkes

In mechanism design one typically seeks socially optimal mechanisms constrained by incentive compatibility. By replacing this constraint with the goal of minimizing expected ex post regret, we are able to adapt statistical machine learning techniques to the design of payment rules in settings with multi-dimensional types. Specifically, we train a support vector machine with a special discriminant function, such that it implicitly establishes a payment rule with desirable properties.

■ SD63

63- Borein B- Hyatt

Joint Session Behavioral Oper./ MSOM: Empirical Studies of Behavioral Factors

Sponsor: Behavioral Operations & Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Bradley Staats, Assistant Professor, University of North Carolina-Chapel Hill, McColl Building, CB 3490, Chapel Hill, NC, 27599, United States of America, Bradley_Staats@kenan-flagler.unc.edu

1 - Learning from My Success and from Others' Failure
Bradley Staats, Assistant Professor, University of North Carolina-Chapel Hill, McColl Building, CB 3490, Chapel Hill, NC, 27599, United States of America, Bradley_Staats@kenan-flagler.unc.edu, Diwas KC, Francesca Gino

Drawing on attribution theory, we investigate how individuals learn from failure and success. We use 10 years of data from 71 surgeons using a new cardiac surgery technology. We find that individuals learn more from their own successes than from their own failures, while they learn more from the failures of others than they do from others' successes. We also find that individuals' prior successes and others' failures help individuals overcome their inability to learn from their own failures.

2 - A Hard Take on a Soft Asset? A Test of an Operational Approach to Human Resource Management
Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Valery Yakubovich

We analyze empirically agent behavior at a virtual call center in which work is allocated according to performance-based hierarchy. We use a controlled experiment to disentangle the effect of this system on agent performance.

3 - Waiting Patiently: Abandonment from Emergency Department Queues
Robert Batt, The Wharton School, University of Pennsylvania, 3730 Walnut St., Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, batt@wharton.upenn.edu, Marcelo Olivares, Christian Terwiesch

We present an empirical study of patient abandonment behavior from a hospital emergency department queue. We show that patients respond differently to queue length and expected wait time despite the fact that these two measures are proportional to each other. We also consider the impact of providing wait time estimates to patients and under what conditions this can lead to reduced social welfare.

4 - Innovation and Learning in the Use of Components
Kamalini Ramdas, Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kramdas@london.edu, Khaled Saleh, Steven Stern, Haiyan Liu

We examine learning in the context of hip replacement surgery using a dataset from a major US hospital. We find that the learning associated with individual surgeons' experience is driven by their experience at the micro level of specific device variants, with implications for how surgery is managed and taught, and for innovation in medical devices.

■ SD66

66- Ellis West- Hyatt

Mining Time Series Data

Sponsor: Data Mining

Sponsored Session

Chair: Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu

1 - Causal Inference for Time-series Analysis: Simultaneous Denoising and Feature Selection
Mohammad H. Poursaeidi, University of Houston, E 209 Engineering Building, Houston, TX, United States of America, mhpoursaeidi@uh.edu, Erhun Kundakcioglu

We present a new hyperplane based approach that performs regression and feature selection while simultaneously removing noise from time-series data. Mixed integer nonlinear programming formulations are developed for linear regression. These formulations are also extended via kernel trick to perform nonlinear regression. The problem is proven to be NP-hard and a heuristic algorithm is developed for large data sets.

2 - Supervised Time Series Pattern Discovery through Local Importance
Mustafa Baydogan, Graduate Research Assistant, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, mbaydoga@asu.edu, George Runger, Eugene Tuv

In time series classification, nearest neighbor (NN) classifiers lack the aspect of interpretability since they are based on the similarity of the whole time series although temporal relations within the time series are important. We present an exploratory approach that finds the regions of the time series that have potentially representative patterns used for classification based on a local importance measure. Our algorithm provides comparable and interpretable results than competitive methods.

3 - Online Piecewise Linear Segmentation and Temporal Pattern Extraction of Time Series Data
Art Chaovalitwongse, University of Washington, 3900 Stevens Way, Seattle, WA, United States of America, artchao@u.washington.edu, Shouyi Wang

Piecewise linear segmentation (PLS) is popular to monitor and summarize time series patterns online. This talk presents a robust and efficient online segmentation algorithm that can be easily applied to various time series using a data-driven decomposition strategy and a closed-form online updating formula. A set of skeleton-point-based features are proposed to characterize time series temporal patterns. Two real-world applications demonstrate the effectiveness of the proposed approaches.

4 - Information-theoretic Feature Selection with Discrete k-Median Clustering
Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu, Elan Borenstein, Art Chaovalitwongse, Ya-Ju Fan

We propose a novel information-theoretic feature selection method using discrete k-median (DKM) clustering, where the center for each cluster is represented as a set of samples. Normalized mutual information (NMI) scores between the output of DKM and the clusters formed by the projection of center samples are used for feature selection. Average of NMI scores are used for determining the number of clusters. We present results on simluated data and real-life neural time series data.

■ SD67

67- Ellis East- Hyatt

Joint Session QSR/ENRE: Variability and Uncertainty in Renewable Power Systems

Sponsor: Quality, Statistics and Reliability & Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Eunshin Byon, Assistant Professor, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ebyon@umich.edu

1 - On-site Renewable Generation: Portfolio Selection and Contracts under Uncertainty
Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Sangho Shim, Jorge Arinez, Stephan Biller

Investment decisions about on-site renewable generation for industrial sites are driven by net present value which inhibits many uncertainties. We present an optimization model for portfolio selection and an options contract. The uncertainties are driven by prices of renewable energy credits, on-site usage and output of sources, and future grid rates.

2 - Grid Integration and R&D policy
Erin Baker, University of Massachusetts, Amherst, MA, United States of America, edbaker@ecs.umass.edu, Noubara Djimadoumbaye

In previous work we have analyzed the optimal energy technology R&D portfolio in the face of climate change, considering solar PV, CCS, and nuclear. Here we consider how the results are impacted by two very different assumptions regarding the integration of solar PV onto the grid. We apply a mutli-model, decision making under uncertainty framework.

3 - A GIS, Optimization and Simulation Framework for Optimal PV Size and Location in Campus Environments
Amirreza M. Khaleghi, The University of Arizona, 1127 E. James E. Rogers Way P.O. Box 21, Tucson, AZ, 85721-0020, United States of America, amirreza@email.arizona.edu, Ye Zhang, Ferenc Szidarovszky, Guzin Bayraksan, Young-Jun Son, Sadik Kucuksari, Maryam Hamidi

A framework integrating GIS, optimization, and simulation modules is proposed to obtain the optimal placement and size for photovoltaic (PV) panels in a campus area. The GIS module finds the suitable rooftops and their panel capacity. The optimization module is then used to maximize the long term profit of PV installations. Voltage profile of the electricity distribution network is investigated in the simulation module. The proposed framework has been successfully demonstrated for a real case.

4 - Assessing Extreme Loads on Wind Turbines by using Aerodynamic Simulation
Eunshin Byon, Assistant Professor, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ebyon@umich.edu, Youngjun Choe

We develop a new methodology to predict an extreme load on a wind turbine by employing high-fidelity simulation. Due to a small probability of extreme events, crude Monte Carlo simulation requires extensive runs, which is computationally prohibitive. We devise an efficient sampling method to guide the simulation to generate the extreme events more frequently with minimal efforts. The proposed method is applied to an aerodynamic simulation.

■ SD68

68- Suite 312- Hyatt

Finance: Financial Engineering

Contributed Session

Chair: Xiangwei Wan, Assistant Professor, Shanghai Jiao Tong University, 535 Hua Fa Zhen Road, Shanghai, China, xwwan@sjtu.edu.cn

1 - A Neuro-wavelet Method for the Forecasting of Financial Time Series

Luis Ortega, PhD Candidate, Financial Engineering, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, lortega@stevens.edu

We propose a wavelet neural network model (neuro-wavelet) for the short-term forecast of stock returns from high-frequency financial data. The proposed hybrid model combines the inherent capability of wavelets and artificial neural networks to capture nonstationary and nonlinear attributes embedded in financial time series. Reasonable forecasting accuracy for one, three and five step-ahead horizons was achieved by the proposed Jordan neuro-wavelet model when compared against five other models.

2 - Analysis of Non-linear Behavior - A Sensitivity-based Approach

Xiangwei Wan, Assistant Professor, Shanghai Jiao Tong University, 535 Hua Fa Zhen Road, Shanghai, China, xwwan@sjtu.edu.cn

The standard dynamic programming fails to work in behavioral analysis due to the distortion in performance probability. In this paper, we apply a sensitivity-based approach to solve the portfolio management problem in an environment with probability distortion and obtain a closed-form optimal policy. We expect that this approach is generally applicable to optimization in other non-linear behavioral analysis.

3 - Game Russian Option with the Finite Maturity

Atsuo Suzuki, Meijo University, Nijigaoka 4-3-3, Kani, Japan, atsuo@urban.meijo-u.ac.jp, Katsushige Sawaki

We consider Game Russian options with the finite maturity. Game Russian option is a contract that the seller and the buyer have the rights to cancel and to exercise it at any time, respectively. We discuss the pricing model of Game Russian options when the stock pays dividends continuously. We show that the pricing model can be formulated as a coupled optimal stopping problem which is analyzed as Dynkin game.

4 - Estimation of Stochastic Volatility Models for Commodities with Few Options

Gonzalo Cortazar, Pontificia Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago, Chile, gcortaza@ing.puc.cl, Federico Alonso

Stochastic volatility models are required for commodity prices. To obtain good parameter estimates, prices for non-linear derivatives with different maturities are necessary, but some commodities trade only futures and short-term options. We propose a three-factor multicommodity model with stochastic volatility and show how to use long-term options written on one commodity to help estimate the dynamics of another. The model is implemented for Brent and WTI commodities with excellent results.

■ SD69

69- Suite 314- Hyatt

Optimization and Financial Engineering

Cluster: Optimization in Finance

Invited Session

Chair: Martin Haugh, Columbia, martin.b.haugh@gmail.com

1 - Hope, Fear and Aspirations

Xuedong He, Assistant Professor, Columbia University, 316 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, xh2140@columbia.edu

We propose a rank-dependent portfolio choice model in continuous time that captures the role in decision making of three emotions: hope, fear and aspirations. We solve the portfolio choice problem both thoroughly and analytically, and these solutions motivate us to introduce a fear index, a hope index and a lottery-likeness index to quantify the impacts of three emotions, respectively, on investment behavior.

2 - Approximate Methods for Dynamic Portfolio Choice with Learning

Poomyos Wimonkittiwat, University of California-Berkeley, Berkeley, CA, United States of America, poomyos@berkeley.edu, Andrew Lim

We develop approximate methods for dynamic portfolio choice problems with hidden states, where the transition probabilities may also need to be learned. We derive semi-explicit expressions for the optimal policy which can be implemented using tools from MCMC.

3 - Martingale Dual Methods for Zero-Sum Games

Chun Wang, Columbia University, 500 West 120th Street, Mudd 323, New York, NY, 10027, United States of America, cw2519@columbia.edu, Martin Haugh

Martingale duality based on information relaxations has recently been developed for zero-sum optimal stopping games. In this talk, we consider generalizing this duality for more general zero-sum dynamic games.

4 - Portfolio Selection with Multiple Spectral Risk Constraints

Carlos Abad, Columbia University IEOR, 500 W 120th St., New York, NY, 10027, United States of America, ca2446@columbia.edu, Garud Iyengar

We propose an iterative algorithm to efficiently solve the portfolio selection problem with multiple spectral risk constraints (CVaR is a special case of the spectral risk function). In each step, the algorithm solves a very simple separable convex quadratic program. We report numerical results that show that our proposed algorithm is very efficient, and is at least two orders of magnitude faster than the state of the art general purpose solver for all practical instances.

■ SD70

70- Suite 316- Hyatt

Social Media and Social Broadcasting Network

Sponsor: Information Systems

Sponsored Session

Chair: Huaxia Rui, University of Texas at Austin, Austin, TX, United States of America, huaxia@utexas.edu

1 - Modeling Multicategory Online Video Demand in Social Media

Qian Tang, University of Texas at Austin, Austin, TX, 78703, United States of America, qian.tang@phd.mccombs.utexas.com, Liangfei Qiu, Andrew Whinston

The popularity of social media has greatly increased the demand for online videos. The demand for online videos may be influencd by online WOM, social influence, the provider's reputation, and competition. Our paper disentangles the influence of these factors. We model a viewer's decision as first choosing categories and then videos within the categories. The hierarchical model allows videos within a category to have correlated demand.

2 - The Value of Being Social: How Bloggers Attract Followers

Hailiang Chen, City University of Hong Kong, Department of Information Systems, Hong Kong, Hong Kong-PRC, chenhl.2007@gmail.com, Yu Hu, Prabuddha De

In a blog community, for a blogger to build readership and gain popularity, ultimately, the key should be to write good quality content. However, from a marketing perspective, how much additional value does being social with her readers bring about to the blogger? This study intends to quantify the value of being social in the blogging context and to examine how bloggers should manage their conversations with readers.

3 - Information Exchange in Prediction Markets: How Social Networks Promote Forecast Efficiency

Liangfei Qiu, University of Texas at Austin, 2225 Speedway, Austin, TX, 78712, United States of America, qiuliangfei@gmail.com, Andrew Whinston, Huaxia Rui

This paper studies the effects of information exchange and social networks on the performance of prediction markets. We provide a game-theoretic framework to resolve the question: Can social networks and information exchange promote the forecast efficiency in prediction markets? Our study shows that social network is not a panacea in terms of improving forecast efficiency. The abuse of social networks could be detrimental to forecast performance.

■ SD71

71- Suite 318- Hyatt

Management and Economics of IS

Sponsor: eBusiness

Sponsored Session

Chair: Dennis Kundisch, Professor, University of Paderborn, Warburgerstrasse 100, Paderborn, Germany, dennis.kundisch@wiwi.uni-paderborn.de

1 - IT Investments and the Structure of Production
Fengmei Gong, University of Calgary, Haskayne School of Business, Calgary, Canada, fgong@ucalgary.ca, Barrie Nault

We examine the potential for determining how investments in information technology (IT) from an industry and its value chain partners affects the input-output structure of production.

2 - Valuation of Interdependent IT Projects – A Real Option Approach Considering Unhedgeable Risks
Steffen Zimmermann, Assistant Professor, University of Innsbruck, Universitaetsstr. 15, Innsbruck, 6020, Austria, Steffen.Zimmermann@uibk.ac.at, Marcel Mueller, Sebastian Stöckl

To value interdependent IT projects, financial option pricing models like the Black-Scholes model (BSM) are frequently suggested. However, one major concern about applying these models for real options, is the assumption that all risks need to be hedged by a replicating portfolio. Thus, we present an enhancement of the BSM where we consider hedgeable and unhedgeable risks by two seperate stochastic processes. In doing so, we find out that the BSM undervalues real options systematically.

3 - Risk-aware SLA Design for Enterprise Information Systems
Dirk Neumann, Professor, Albert-Ludwigs Universitat Freiburg, Platz der Alten Synagoge 1, Freiburg, 79085, Germany, dirk.neumann@is.uni-freiburg.de, Markus Hedwig, Simon Malkowski

Since effective IT systems are necessary for business practices, growing operation costs necessitate the search for efficient delivery models. Cloud Computing provides a powerful alternative to traditional IT operation. Firms still have reservations about migrating to the Cloud due to the lack of binding SLA offerings. Service providers hesitate to offer binding SLAs as assessing economic risks is challenging. We present a model for SLA design for clouds to estimate the induced operational risk.

4 - Does It Pay Off to Bid Aggressively? An Empirical Study
Philipp Herrmann, University of Paderborn, Warburger Strafle 100, Paderborn, Germany, Philipp.Herrmann@wiwi.uni-paderborn.de, Mohammad Rahman, Dennis Kundisch

We empirically investigate the payoff of aggressive bidding in an electronic auction. We use a unique and very rich dataset containing actual market transaction data for approximately 7,000 pay-per-bid auctions. Our research design allows us to separate the effect of an aggressive bidding strategy to signal one's own valuation from the effect of bidding aggressively due to impatience. We find a strong and significantly negative effect of aggressive bidding on the likelihood to win an auction.

■ SD72

72- Suite 322- Hyatt

Advances in Optimization Modeling Languages and Systems I

Cluster: ICS-Advances in Optimization Modeling Languages and Systems

Invited Session

Chair: Robert Fourer, President, AMPL Optimization, Inc, 2145 Sheridan Road, Evanston, IL, United States of America, 4er@ampl.com

1 - A Generic Benders Decomposition Algorithm for the AIMMS Modeling Language
Marcel Hunting, Paragon Decision Technology, Schipholweg 1, Haarlem, 2034 LS, Netherlands, Marcel.Hunting@aimms.com

We present an implementation of Benders Decomposition, in the AIMMS modeling language, that is easy to use on a broad class of problems. The user only needs to specify which variables belong to the master problem and which to the subproblems. Benders' cuts are generated automatically. Several cut selection criteria are available. The Benders Decomposition algorithm is implemented as a white box algorithm.

2 - Automated Conversion of Common Optimization Problem Structures to Mixed-integer Linear Programs
Jared Erickson, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, JaredErickson2012@u.northwestern.edu, Robert Fourer

Optimization problems conveniently represented through the use of disjunctive linear constraints or polynomials in binary variables are commonly recast as MILPs for solution. We present algorithms that detect these types of problems and transform them to MILPs automatically. Our implementation uses the AMPL modeling language and works with various solvers. The transformations allow for a wider variety of solvers to be used and can lead to reductions in solution time.

3 - ZIMPL 3.3: An Open Source Modelling Language
Gerald Gamrath, Research Assistant, Zuse-Institut Berlin, Takustr 7, Berlin, 14199, Germany, gamrath@zib.de, Thorsten Koch

ZIMPL is a freely available open source algebraic modelling language for describing linear and non-linear mixed integer programs. It is very portable and can be used either standalone, embedded into an application, or linked to a solver. One feature of ZIMPL is the use of rational arithmetic for all computations. We will give an overview of the latest release and in particular to the SCIP integration, which interfaces with the exact solver version of SCIP and also with the MINLP solver.

4 - APMonitor Modeling Langauge for Mixed-integer Differential Algebraic Systems
John Hedengren, Assistant Professor, Brigham Young University, 350 CB, Provo, UT, 84602, United States of America, john_hedengren@byu.edu

The APMonitor Modeling Language (APM) is an optimization platform for differential and algebraic equations (DAEs) and is coupled with large-scale solvers for data reconciliation, dynamic optimization, and nonlinear predictive control. Applications include computational biology, unmanned aerial systems, chemical process control, smart grid optimization, and oil and gas upstream monitoring systems.

■ SD73

73- Suite 324- Hyatt

Stochastic Optimization in Finance

Cluster: Quantitative Finance

Invited Session

Chair: Tim Siu-Tang Leung, Columbia University, New York, NY, United States of America, leung@ieor.columbia.edu

1 - Utility Maximization in Hidden Regime Switching Markets
Agostino Capponi, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States of America, capponi@purdue.edu

We consider a regime switching market, where investors can trade a stock, a risk-free bond, and a defaultable bond, whose price is only observed with noise. The dynamics of the instruments are driven by hidden Markov chains. We provide the HJB equations for the partially observed stochastic control problem, and demonstrate how to solve them numerically. We then illustrate the dependence of the strategies on the level of noise in market, risk aversion of the investor, and default risk.

2 - Portfolio Optimization under Convex Incentive Schemes
Maxim Bichuch, Princeton University, Dept. of Operations Research and Finance, Sherrerd Hall, Charlton Street, Princeton, NJ, 08544, United States of America, mbichuch@princeton.edu, Stephan Sturm

We consider a utility maximization problem of terminal wealth from the point of view of a portfolio manager paid by convex incentives. Even though the manager's utility function is concave, the result is a non-concave optimization problem that does not fit into the classical portfolio optimization theory. Using duality theory, we prove existence and uniqueness of the optimal wealth in general (incomplete) markets.

3 - Optimal Incentives for Delegated Portfolio Selection
Stephan Sturm, Worcester Polytechnic Institute, c/o Princeton University, 116, Sherrerd Hall, Princeton, NJ, 08544, United States of America, ssturm@princeton.edu, Maxim Bichuch

We study the problem of an investor who lets a fund manager manage his wealth. The latter is paid by an incentive scheme based on the performance of the fund. Manager and investor have different risk aversions; the manager may invest in a financial market to form a portfolio optimal for his expected utility whereas the investor is free to choose the incentives – taking only into account that the manager is paid enough to accept the managing contract.

4 - Private Valuation of Claims using Stochastic Programming
Alan King, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com, Olga Streltchenko

Valuing contingent claims can be formulated as a stochastic programming problem. We explore the advantages of the SP model in modeling realistic aspects of investing, including: calibration constraints, existing positions, spreads, and risk preferences. Capturing these realistic features of investing and hedging leads to a paradigm in which investors can construct and calibrate a private valuation measure for the evaluation of trades and the pricing of illiquid positions.

Monday, 8:00am - 9:30am

■ MA01

01- West 101- CC

Recent Advances in Nonlinear Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Evrim Dalkiran, Assistant Professor, Wayne State University, 4815 4th St Manufacturing Eng., Detroit, Mi, 48202, United States of America, evrimd@wayne.edu

1 - Disjunctive Cutting Planes for Linear Complementarity Constraints
Trang Nguyen, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, trang@ufl.edu, Jean-Philippe Richard, Mohit Tawarmalani

We discuss the problem of generating strong cutting planes for linear programs with linear complementarity constraints (LPCCs). In particular, we exploit complementarity constraints to derive cuts from the optimal simplex tableaux of the LP relaxation of the problem. We also introduce the notions of split cut and split closure for LPCC problems with bounded variables. We compare these notions with their integer programming counterpart and present preliminary numerical results.

2 - Complexity of Deciding Convexity
Amir Ali Ahmadi, Postdoctoral Associate, Massachusetts Institute of Technology, 195 Binney St., Cambridge, MA, 02142, United States of America, a_a_a@mit.edu

We show that deciding convexity of polynomials of degree as low as four is strongly NP-hard. This solves a problem that appeared as one of seven open problems in complexity theory for numerical optimization in 1992. Joint work with A. Olshevsky, P.A. Parrilo, and J.N. Tsitsiklis.

3 - An Algorithm for the Projection a Point on the Intersection of Two Nonnegative Hyperplanes and the Nonnegative Orthant
Claudio Santiago, Postdoc Researcher, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA, 94550, United States of America, pratas@gmail.com, Nelson Maculan, Maria Helena Jardim

In this work, we present a quadratic algorithm for the projection of a point on the intersection of two hyperplanes with nonnegative coefficients and the nonnegative orthant. Interior point methods are the most efficient algorithm in the literature to solve this problem. While efficient in practice, their efficiency is highly dependent on a series of parameters (especially for nonlinear problems). We propose a new method based on the KKT optimality conditions.

■ MA02

02- West 102 A- CC

Issues and Advances in Real Options

Sponsor: Decision Analysis

Sponsored Session

Chair: Reidar Bratvold, Professor, University of Stavanger, Department of Petroleum Engineering, Stavanger, 4036, Norway, reidar.bratvold@uis.no

Chair: Joe HahnAssociate Professor, Pepperdine University, Malibu Campus, Malibu, CA, United States of America, Joe.Hahn@pepperdine.edu

1 - Recent Developments in Valuation to Support Real Asset Decision-Making: A CO2 Storage Example
David Laughton, Principal/Adjunct Professor, David Laughton Consulting Ltd./University of Alberta School of Business, 11006-125 St., Edmonton, AB, T5M 0M1, Canada, laughton.david@davidlaughtonconsulting.ca

Value is an important metric in many large public corporations shaping the process of designing and choosing real assets. Separating and adopting the two aspects of so-called "real options" valuation (derivative asset valuation and decision tree analysis) can produce a technically superior form of valuation that conforms with the organisational structures and work flows in these corporations. This increases the net benefit of adopting the proposed changes and makes it less costly to do so.

2 - A Decision Analysis Approach to Valuing Real Options
Ross Shachter, Associate Professor, Stanford University, Department of Management Science and Eng, Huang Engineering Center, Stanford, CA, 94305, United States of America, shachter@stanford.edu, Stephen Derby

We extend the standard finite-state multiple-period model of investment in a real option by including return to scale (RTS), the derivative of the buying price with respect to the scale of investment. RTS is either constant or decreasing, depending on whether all of the investment risk can be hedged, as assumed in financial option pricing theory. RTS increases with wealth and trading frequency. We provide bounds and approximations for the investment value without imposing constant RTS.

3 - Risk-Sensitive Real Options Decisions
H. Dharma Kwon, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu, Michael Lim

We consider a class of stopping problems under uncertainty with non-linear utility functions. We focus on stationary stopping problems and consider stationary stopping policies. We formulate credible stationary stopping policies, from which the decision-maker will have no incentive to deviate.

4 - The Choice of Stochastic Process in Real Option Valuation
Luiz Ozorio, Professor, IBMEC Business School, Av. Afranio de Melo Franco 149/403, Rio de Janeiro, RJ, 22430-060, Brazil, lmozorio@ibmecrj.br, Luiz Eduardo Brandao, Adrian Pizzinga, Carlos Bastian-Pinto

A main issue in valuation modeling is the choice of the stochastic process that describes the asset price performance. Particularly, in investment projects that show a high level of managerial flexibility in conditions of uncertainty the assumption of a specific process can have an impact on the project value and the investment rule. This work discusses the choice of stochastic process in real options valuation and useful tests and theoretical considerations to give support to this task.

■ MA03

03- West 102 B- CC

Joint Session: DAS/Emergency Mgmt: Security and Behavioral Game Theory

Sponsor: Decision Analysis & Applications in Emergency Management and Terrorism Security

Sponsored Session

Chair: Richard John, Associate Professor of Psychology, University of Southern California, Los Angeles, CA, United States of America, richardj@usc.edu

Co-Chair: Heather Rosoff, University of Southern California, Los Angeles, CA, United States of America, rosoff@usc.edu

1 - Security Games: Challenges in Modeling Human Adversarial Behavior
Milind Tambe, University of Southern California, Los Angeles, CA, United States of America, tambe@usc.edu, Rong Yang, James Pita

Stackelberg security games have received significant attentions in recent years given their deployment for real-world security problems. Many of these real-world systems have adopted the standard game-theoretic assumption that the adversaries are perfectly rational; this assumption may not hold when facing human adversary with bounded rationality. We provide an overview of our research efforts to address human bounded rationality in the context of security games.

2 - Data-driven Analysis of Spatiotemporal Human Behavior
Rajiv Maheswaran, Research Assistant Professor, University of Southern California, 4676 Admiralty Way #1001, Marina Del Rey, CA, United States of America, maheswar@isi.edu, Yu-Han Chang

In security, energy, transportation, communication and even sports, we've seen an expanding ability to gather fine-grained data about societies of agents engaging in spatial and temporal behavior. We present computational tools and techniques in combination with machine learning and statistical approaches to learn underlying behavior patterns. These patterns can be leveraged to more deeply understand the domain and create strategies to improve policy making in these arenas.

3 - Robust Solutions to Human Adversaries in Security Domains
James Pita, University of Southern California, PHE 101, 3737 Watt Way, Los Angeles, CA, 90089, United States of America, jpita@usc.edu, Milind Tambe, Richard John

Recently, game theory has been shown to be useful for reasoning in security settings about how to optimally allocate limited security resources to best defend a set of critical assets. In real-world scenarios the adversaries considered are human adversaries who may not behave according to the standard assumptions of game-theoretic models. We investigate a number of robust approaches and human decision-making models to better address human decision-making in such critical security settings.

4 - Modeling and Exploiting Adversary Risk Attitudes and Trade-offs Among Conflicting Objectives
Richard John, Associate Professor of Psychology, University of Southern California, Los Angeles, CA, United States of America, richardj@usc.edu, Heather Rosoff

Terrorists and other adversaries generally have multiple and conflicting objectives that underlie attack motivations. We describe defender strategies that explicitly model attacker risk attitudes and attacker trade-offs among conflicting objectives. We also report on behavioral lab studies that assess the fit of these attacker models, and compare the performance of competing defender strategies that explicitly account for attacker risk attitudes and trade-offs.

■ MA04

04- West 102 C- CC

Decision Making in Interdependent Systems

Sponsor: Decision Analysis

Sponsored Session

Chair: Kash Barker, Assistant Professor, School of Industrial and Systems Engineering, University of Oklahoma, 202 W. Boyd St., Rm 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Optimization of Resilience in Interdependent Infrastructure Systems
Hiba Baroud, Graduate Student, School of Industrial and Systems Engineering, University of Oklahoma, 202 W. Boyd St., Rm. 124, Norman, OK, 73019, United States of America, hbaroud@ou.edu, Kash Barker, Jose Ramirez-Marquez, Claudio Rocco

Decision making in infrastructure systems involves both preparedness and post-disaster decisions. Using a set of stochastic metrics, network resilience is modeled to minimize the cost and the time to full recovery of the failed system, consequently guiding decision making and resource allocation after the disruptive event. This methodology is applied to the Mississippi River Navigation System using simulation scenarios of possible accidents, natural disasters, or manmade attacks.

2 - Robust Static Resilience Planning for Controlling Interdependent Infrastructure Economic Risk
Raghav Pant, University of Oxford, South Parks Road, Oxford, United Kingdom, raghavp@gmail.com, Kash Barker

This study uses economic I-O models for static resilience planning in interdependent sectors and data and events for planning are uncertain. We answer: How can shock impact be minimized to restore economic equilibrium? What is the nature of problem uncertainties? Can we guarantee solutions are robust to uncertainties? We combine robust optimization and risk I-O models for a robust static resilience planning problem to provide worst-case planning and risk scenarios in resilience decision-making.

3 - A Network Flow Approach for Design Improvements in Interdependent Civil Infrastructures
Guisselle Garcia Llinas, Student Professor, University at Buffalo, Universidad del Norte, 438 Bell Hall, Km 5 Via a Puerto Colomb, Buffalo, Barranquilla, NY, 14260, United States of America, gagarcia@buffalo.edu, Moises Sudit, Rakesh Nagi

Network flows have been traditionally used to redesign individual infrastructures. We formulate an integrated layered network model to represent the interdependencies among multiple infrastructures and evaluate design choices (increasing capacity or a new link). The objective is to reduce the vulnerability of the overall system to natural and man-made disasters while respecting budget constraints over a planning horizon. Numerical studies will be presented.

■ MA05

05- West 103 A- CC

2012 QSR Best Student Paper Competition

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Rajesh Ganesan, George Mason University, 4400 Univ Dr. MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu

1 - Real-time Prognostics for Multi-component Systems with Degradation-rate-interactions
Linkan Bian, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive, NW, Groseclose 0205, Room 417, Atlanta GA 30332, United States of America, linkanbian@gatech.edu

In many engineering systems, such as smart grids, water distribution systems, and various mechanical systems, the system lifetime is affected by those of individual components and their interactions. In this work, we present a degradation framework that characterizes the interactions among the degradation processes of components and predict component residual life times using real-time sensory data. We conduct a series of simulation studies and compare the performance of our approach with a benchmark model. The results show that our prediction of the residual life distribution is more accurate, compared with the benchmark model, in which component interactions are not taken into account.

2 - Physician Performance Assessment using a Composite Quality Index
Kaibo Liu, Research Assistant, H. Milton Stewart School of Industrial and Systems Engineering, 765 Ferst Drive, Room 109, Georgia Institute of Technology, Atlanta GA 30332, United States of America, kbliu@gatech.edu

This paper proposes a generic approach to develop a single composite index for physician performance assessment by using nonnegative principal component analysis. A new algorithm, named iterative quadratic programming, is developed to solve the numerical issue. In addition, statistical process control technique is implemented to explain physician performance for improvement purposes.

3 - Tractable Functional Response Modeling using Nonstationary Covariance Functions
Matthew Plumlee, PhD Student, The Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta GA 30332, United States of America, mplumlee@gatech.edu

Gaussian process models have become increasingly popular to model functional responses. Fitting these models requires computationally expensive matrix decomposition, a problem exacerbated with functional responses. Separability assumptions on the covariance function eases the computational burden. This work models these functions without the separability assumption while maintaining the computational advantages.

4 - Cross-domain Model Building and Validation (CDMV): A New Modeling Strategy to Reinforce Understanding of Nanomanufacturing Processes
Li Wang, University of Southern California, 3715 McClintock Ave., RM 236, Los Angeles CA 90089, United States of America, wang40@usc.edu

Understanding nanostructure growth faces issues of limited data, lack of physical knowledge, and large process uncertainties. These issues result in modeling difficulty because a large pool of candidate models almost fit the data equally well. Through the Integrated Nanomanufacturing and Nanoinformatics (INN) strategy, we derive the process models from physical and statistical domains, respectively, and reinforce the understanding of growth processes by identifying the common model structure across two domains. We present this method by studying the weight growth kinetics of silica nanowire under two temperature conditions. The derived nanowire growth model is able to provide physical insights for prediction and control under uncertainties.

■ MA06

06- West 103 B- CC

Simulation and Stochastic Optimization

Sponsor: Simulation

Sponsored Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 106 Burleigh Dr, Ithaca, NY, 14850, United States of America, pf98@cornell.edu

1 - Mutual Information Based Matching for Causal Inference with Observational Data

Alexander Nikolaev, University of Buffalo, Department of Industrial and Systems Engr., Buffalo, NY, 14260, United States of America, anikolae@buffalo.edu, Lei Sun

Balance Optimization Subset Selection (BOSS) approach addresses the problem of treatment effect estimation when units under study cannot be randomly selected for treatment. Minimizing mutual information leads to a BOSS model that reduces this selection bias by finding data subsets, across which treatment is minimally dependent on covariates, thus increasing estimation accuracy.

2 - Analysis of Direct Search Methods Combined with a Local Metamodeling Approach in Simulation Optimization

Sicong Ma, National University of Singapore, 07-17 QRE Lab, Blk E1, ISE Dept, NUS, Singapore, 117576, Singapore, ma_sicong@nus.edu.sg, Sujin Kim, Wendy Xu

We propose a framework to include local metamodels for some direct search methods for both deterministic and stochastic optimization problems to improve the algorithm efficiency without affecting the convergence.We discuss the conditions of the metamodels and the objective functions under which the effectiveness of using metamodels is guaranteed.Numerical results with a wide variety of test problems show that local meta models can help even when the regularity conditions are not fully satisfied.

3 - Bayesian Multi-armed Bandits in Recommender Systems

Xiaoting Zhao, Cornell University, Rhodes Hall, Ithaca, NY, 14850, United States of America, xz337@cornell.edu, Peter Frazier

We consider a Bayesian contextual multi-armed bandit problem arising in recommender systems, motivated by an application to the arXiV repository of scholarly papers. In this problem, we wish to recommend items (e.g., movies, or scientific articles) to users of a website, and use the feedback to better learn their preferences. We provide an algorithm that is Bayes-optimal under a simplifying orthogonality assumption, as well as a general upper bound on the value of the Bayes-optimal algorithm.

■ MA07

07- West 104 A- CC

Joint Session DM/MAS: Analytics Applied to Social Media

Sponsor: Data Mining & Military Applications

Sponsored Session

Chair: Les Servi, The MITRE Corporation, 202 Burlington Road, Bedford, MA, 01730, United States of America, lservi@mitre.org

1 - Real-time Sentiment Analysis with the 'Hedonometer'

Brian Tivnan, Senior Principal, The MITRE Corporation, 7500 Colshire Dr, McLean, VA, United States of America, btivnan@mitre.org

Building on earlier psychological research, the Hedonometer is an instrument to 'remotely-sense' emotional states and levels, in real time or post hoc. Here, we provide an update on the development of the Hedonometer, its extension beyond native English to a multitude of languages and the recent development of a real-time capability to perform sentiment analysis.

2 - Mining Information from Deconstructed Social Networks

Guido Zarrella, MITRE Corporation, 202 Burlington Rd, Bedford, MA, 01730, United States of America, jzarrella@mitre.org

Social media offers unprecedented insight into the attitudes of large populations, but the potential for misuse of data mining algorithms is high. We demonstrate that a deconstructed view of social networks can help to provide additional context, enabling a better understanding of patterns in the data.

3 - A Mathematical Approach to Identifying and Forecasting Shifts in the Mood of Social Media

Les Servi, The MITRE Corporation, 202 Burlington Road, Bedford, MA, 01730, United States of America, lservi@mitre.org, Sara Beth Elson

Public mood is examined by: (i) running an existing system, LIWC, to estimate the emotional intensity of individual tweets; (ii) infer the dynamics of the aggregate mood after first detecting times where those mood changed abruptly, and (iii) forecast future moods. This work is illustrated and validated with real data.

4 - Realizing the Vision of Social Radar

Captain Dylan Schmorrow, Office of the Assistant Secretary of Defense (Research and Engineering), 4800 Mark Center Drive, Suite 17E08, Alexandria, VA, Dylan.Schmorrow@osd.mil

To meet current and emerging challenges, we need a 'social radar' (integrated capabilities for situation awareness) which include alerting, course of action analysis, and measures of effectiveness). CAPT Schmorrow will describe the needs for a Social Radar, discuss leading technical challenges, and share some early successes realizing the vision.

■ MA08

08- West 104 B- CC

Joint Session SPPSN/MAS: Humanitarian Logistics and Disaster Response II

Sponsor: Public Programs, Service and Needs & Military Applications

Sponsored Session

Chair: Jarrod Goentzel, Massachusetts Institute of Technology, Room E38-650, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, goentzel@mit.edu

1 - Using Expert Preferences to Assess Tradeoffs among Multiple Objectives for Humanitarian Aid Delivery

Erica Gralla, Massachusetts Institute of Technology, Rm. E38-651, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, egralla@MIT.EDU, Charles Fine, Jarrod Goentzel

Modeling approaches can support better humanitarian aid delivery planning, but the trade-offs among the multiple goals of aid delivery are not adequately understood. We develop a measure to value the performance of aid delivery plans, based on expert preferences over five objectives: amount of cargo delivered, prioritization of aid by commodity type, prioritization by location, speed of delivery, and operational cost.

2 - Applying Game Theory to Humanitarian Supply Chains: Literature Review and Future Research Direction

Timothy Muggy, PhD Student, Kansas State University, Industrial and Manufacturing Systems Eng, 2037 Durland Hall, Manhattan, KS, 66502, United States of America, lmuggy@ksu.edu, Jessica Heier Stamm

Humanitarian logistics systems are often characterized by the presence of multiple decision makers who act according to their own objectives, but whose choices impact the entire system. Applications of game theory in this context are increasing due to its ability to model interactions of decentralized agents, yet many opportunities remain to improve humanitarian logistics systems through the use of game theory models. We synthesize existing literature and identify directions for future research.

3 - Managing the Tradeoff between Vehicle Utilization and Depreciation in Humanitarian Operations

Mahyar Eftekhar, PhD Student, HEC Paris, 0334, 1 rue Jean Mermoz, Chatillon, 92320, France, Mahyar.Eftekhar@hec.fr, Luk Van Wassenhove, Andrea Masini

To optimize fleet performance and maximize effectiveness, humanitarian organizations implement policies to enhance individual vehicles' utilization and to reduce their operational cost. Using field data provided by the ICRC, this paper examines the alternative policies recommended by the ICRC Headquarters on the vehicles' depreciation and utilization and derives recommendations for fleet operators. Moreover, it considers whether there is a tradeoff between vehicle's utilization and depreciation.

4 - Humanitarian Staff Reassignment: Incorporating Centralized Utilities into Stable Matchings

Mallory Soldner, Georgia Institute of Technology, Atlanta, GA, United States of America, msoldner@gatech.edu, Ozlem Ergun, Julie L. Swann

Humanitarian organizations regularly face the challenge of reassigning staff member to different positions and countries. We extend the classic Gale-Shapely stable matching model to include centralized utilities for matches for the overall good of the organization. Extensions for couples and decision-making over time are also investigated.

■ MA09

09- West 105 A- CC

Modelling Terrorists' Values and Acts

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Gilberto Montibeller, Lecturer, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, g.montibeller@lse.ac.uk

1 - Adversarial Risk Analysis for Counterterrorism Modelling

Jesus Rios, IBM, Yorktown Heights, NY, United States of America, jriosal@us.ibm.com, David Rios Insua

Recent interest in resource allocation against terrorist threats has inspired the development of methods of analysis for when risks stem from the intentional actions of intelligent adversaries. Most of these approaches have a game theoretic or decision analytic flavor. I provide a critical overview of these approaches and present a new framework of analysis emphasizing how to coherently assess a predictive model on the adversary's actions, in a context of supporting a defender vs. an attacker.

2 - Analysis of Propagation of Disruptions Produced by Terrorist Acts on Global Supply Chains Performance

Alfredo Bueno Solano, Researcher, COMIMSA-National Council of Science & Technology, Calle Ciencia y Tecnologia, No 790, Satillo, Choahuila Mexico, Mexico, alfredo.bueno@gmail.com, Rosa G. Gonzalez-Ramìrez, Miguel Gaston Cedillo-Campos

Understanding the security disruptions and how their effects propagate through the supply chain is critical to promote security and efficient movement of goods. This research proposes systems dynamic as an effective modeling technique for analyzing the effects of the materialization and simultaneous propagation of disruptions of security at various points in supply chains. The article shows that the impact on inventory levels in the chain can increase 600% compared to normal operating conditions

3 - Multi-criteria Decision Analysis and Game Theory: Perspective on Terrorist Archetypes

John Coles, PhD Student, University at Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, jbcoles@buffalo.edu, Jun Zhuang

This paper provides a perspective on how game theory could be used to supplement a Multi-Attribute Utility Theory (MAUT) examination of terrorist actions and reactions. We present a quantitative, stakeholder-driven method to provide a clear understanding about immediate threats and long-term behavioral patterns, building on the current set of literature and proposing MAUT and game theory integration.

4 - Modeling Effects of Counterterrorism Initiatives on Reducing Adversary Threats

Heather Rosoff, University of Southern California, Los Angeles, CA, United States of America, rosoff@usc.edu, Richard John

We describe a general methodology for evaluating counterterrorism alternatives that accounts for an adaptive adversary planning to attack a U.S. target. The central focus of the methodology is a model of terrorist objectives and values using a proxy multi-attribute utility model. Results suggest that terrorist preferences for attack mode are sensitive to certain counter-terrorism strategies and insensitive to others.

■ MA10

10- West 105 B- CC

Scalable Methods in Stochastic Programming

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Miguel Lejeune, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

1 - Mitigating Uncertainty through Decision Simulation with Stochastic Decomposition

Suvrajeet Sen, Professor, University of Southern California, Epstein Department of ISE, Los Angeles, CA, United States of America, sen.22@osu.edu, Yifan Liu

Three popular OR tools, namely, Decision Analysis, Linear Programming, and Simulation come together under one umbrella which we refer to as Decision Simulation. Using stochastic decomposition (SD), we show how one can mitigate the impact of aleatoric as well as epistemic uncertainty in decision simulation.

2 - Threshold Boolean Form for Probabilistically Constrained Problems with Random Technology

Miguel Lejeune, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu, Alexander Kogan

We construct a partially defined Boolean function (pdBf) representing the satisfiability of a joint probabilistic constraint with random technology matrix. We extend the pdBf as a threshold Boolean tight minorant to derive a series of integer reformulations equivalent to the stochastic problem. Computational experiments will be presented.

3 - The Extended Reformulation of Stochastic Lot-sizing Problem with Inventory Bound and Order Capacity

Chaoyue Zhao, cherryzhao09@ufl.edu, Yongpei Guan

We discuss the dynamic programming formulation for stochastic lot-sizing problem in different cases (i.e., with backlogging, inventory bound, order capacity, etc.). We analyze the optimal inventory conditions for each cases, and based on these conditions, we address the extended reformulation of stochastic lot-sizing problem for each cases.

■ MA11

11- West 105 C- CC

Robust Optimization in Network Problems

Contributed Session

Chair: Mukesh Rungta, University of Houston, 4800 Calhoun Rd, Houston, TX, 77004, United States of America, mkrungta@uh.edu

1 - On the Power of Randomization in Robust Optimization and Network Interdiction

Ebrahim Nasrabadi, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-110, Cambridge, MA, 02139, United States of America, nasrabad@mit.edu, James Orlin, Dimitris Bertsimas

We consider optimization problems with uncertain cost coefficients. We present a new framework of robust optimization by allowing the decision maker to select a random strategy, where the adversary's response is based only on knowing the random strategy and not its realization. We show how much the decision maker can improve his expected value by choosing a random strategy. We also analyze the effect of randomization in network interdiction, where it is allowed to choose a random strategy.

2 - Comparison of Solution Space of Random Assignment Problems

Alla Kammerdiner, Assistant Professor, New Mexico State University, P.O. Box 30001, MSC 4230, Las Cruces, NM, 88003-001, United States of America, alla@nmsu.edu

Due to noisy measurements and uncertainty, the cost coefficient for the assignment problems that arise in real world applications, such as multi-sensor multiple target traking, may have errors. Moreover, the errors in the coefficients may not be independent. To account for this, the cost coefficient array can be modeled as a random vector. This study examines how the space of feasible solutions for a random assignment problem changes based on the joint distribution of cost coefficients.

3 - Evacuation Traffic Routing Considering Random Arc Capacity
Mukesh Rungta, University of Houston, 4800 Calhoun Rd, Houston, TX, 77004, United States of America, mkrungta@uh.edu, Gino J. Lim

This study aims on developing and solving regional evacuation routing and scheduling problem for stochastic scenarios. Chance-constrained programming technique is used to address the uncertainty of arc capacity. A deterministic approximation of the model finds the reliability of an evacuation plan and selects the evacuation paths that result in minimum congestion. Experiments showed that the congestion can be avoided with a desired confidence level but at the cost of increased clearance time.

4 - Robust Supply Chain Network Design Models
Ankur Arora, Indian Institute of Management Bangalore, D003 Hostel Block, Arora, 560076, India, ankur.aroraiimb@gmail.com

In this paper, mathematical programming model for uncapacitated facility location problem (UFLP) which forms the basis of other supply chain location models is formulated for robustness under deep uncertainty. The robustness measures used for this mathematical programming are min-max regret and min-max cost. We devise dual-ascent methods that provide good lower bounds and heuristic primal solutions for these problems.

■ MA12

12- West 106 A- CC

Cutting Planes in MIP

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, University of Florida, Department of Industrial and Systems, Engineering 303 Weil Hall, Gainesville, FL, 32608, United States of America, richard@ise.ufl.edu

1 - A New Perspective on Generating Facets for Polyhedral Second-Order Conic Sets
Sujeevraja Sanjeevi, Researcher, Emerging Technologies Building, 3131 TAMU, College Station, TX, 77843, United States of America, sujeevraja@tamu.edu, Kiavash Kianfar

We present a new procedure to develop facets for the polyhedral second-order conic sets. We show that n-step conic MIR inequalities are simply the result of this procedure. We also show that this procedure generalizes to other polyhedral sets and can be used to develop strong valid inequalities based on valid inequalities for simpler sets.

2 - Computational Study of Multidimensional Superadditive Lifting
Bo Zeng, Assistant Professor, University of South Florida, 4202 E Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Long Zhao

Strong valid inequalities generated by multidimensional superadditive lifting method will be implemented and evaluated. Examples include precedence-constrained knapsack and flow cover inequalities for 0-1 mixed integer programs.

3 - On a Transportation Problem with Market Choice
Pelin Damci-Kurt, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems Building, Columbus, OH, 43210, United States of America, damci-kurt.1@osu.edu, Simge Kucukyavuz, Santanu Dey

We study a transportation problem with market choice (TPMC) where suppliers choose a subset of potential markets to serve. We prove that the problem is NP-hard in general and present polynomially solvable cases. For a special case, we show that adding a constraint on the number of unsatisfied markets to the convex hull of solutions to TPMC gives an integral polyhedron. We present strong valid inequalities for TPMC and show their effectiveness in a branch-and-cut algorithm.

4 - Polyhedral Results for Unsplittable Flows
Jean-Philippe Richard, Associate Professor, University of Florida, Department of Industrial and Systems, Engineering 303 Weil Hall, Gainesville, FL, 32608, United States of America, richard@ise.ufl.edu, Ece Icyuz

In various applications it is necessary to model flows problems with the additional restriction that flow is not split at certain nodes of the network. Motivated by this observation, we perform a polyhedral study of the single node unsplittable flow problem, present families of strong inequalities for its convex hull in the space of original variables and describe extended formulations.

■ MA13

13- West 106 B- CC

Optimization Models and Techniques in Radiation Treatment Planning

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Hamid Ghaffari PhD Candidate, University of Toronto, 5 King's College Rd, MIE Department, Toronto, ON, M5S 3G8, Canada, ghaffari@mie.utoronto.ca

1 - A Robust CVaR Optimization Approach to Left-sided Breast Cancer Radiation Therapy
Houra Mahmoudzadeh, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, houra@mie.utoronto.ca, Timothy Chan, Thomas Purdie

We propose a robust-CVaR approach to the breast cancer IMRT problem that enables high quality treatments and is applicable for all patients. Our model guarantees the clinical limits on the organs hold under uncertainty in the breathing pattern. We first solve the problem with the standard robust optimization reformulation using duality theory, and next propose a constraint generation method based on the special structure of the problem.

2 - Iterative Linear Programming Approach for IMRT Dose Optimization
Hao Howard Zhang, University of Maryland School of Medicine, 22 S Greene St., Dept. of Radiation Oncology, Baltimore, MD, 21201, United States of America, hzhan001@umaryland.edu, Robert R. Meyer, Warren D'Souza, Leyuan Shi

We propose an iterative linear programming (LP) approach for Intensity-modulated radiation therapy (IMRT) dose optimization. In contrast to using column generation to solve the large-scale LP, each sub-problem is generated row-wise. Interconnection of the sub-problems is maintained by overall dose distribution and updating all aperture weights. Our approach was tested on challenging clinical cases and achieved superior critical structure sparing. Convergence of our approach is also demonstrated.

3 - Impact of Optimization Methods for Spot Scanning Proton Therapy Treatment Planning
Gino J. Lim, University of Houston, Department of Industrial Engineering, E206 Engineering Bldg 2, Houston, TX, 77204, United States of America, ginolim@uh.edu, Wenhua Cao

Spot scanning proton therapy has become available to cancer patients. However, the problem of optimizing intensities of scanning spots has rarely been explored. We compare two classes of optimization models (linear programming and quadratic programming) by examining their resulting plan quality and delivery efficiency using clinical patient cases with different cancer sites, including head and neck, prostate, and lung.

4 - Machine Learning for Beam Angle Selection in Radiotherapy
Robert R. Meyer, Professor Emeritus of Computer Sciences, University of Wisconsin, 1210 W. Dayton, Madison, WI, 53706-1685, United States of America, rrm@cs.wisc.edu, Leyuan Shi, Warren D'Souza, Hao Howard Zhang, Siyang Gao

An important element of radiation treatment planning for cancer therapy is the selection for a given patient of a set of 5-9 incident radiation beam angles. The quality of a treatment plan may be scored by a piecewise-linear function that measures the deviation from desirable doses for the tumor and surrounding organs. Machine learning tools are used to predict the score components for beam sets in conjunction with a Nested Partitions framework for this global optimization problem.

■ MA14

14- West 106 C- CC

Contemporary Scheduling

Cluster: Scheduling and Project Management

Invited Session

Chair: Joseph Leung, Distinguished Professor, New Jersey Institute of Technology, University Heights, Newark, 07102, United States of America, leung@oak.njit.edu

1 - Scheduling with Multitasking

Nicholas Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, hall.33@osu.edu, Joseph Leung, Chung-Lun Li

This paper considers scheduling under multitasking, i.e. the processing of a selected job is interrupted by other jobs. Multitasking occurs in administration, project management, and manufacturing. Most classical solution methods no longer apply under multitasking. We develop optimal algorithms for several classical single machine problems under multitasking. For one intractable problem, we describe and test a heuristic. For four problems, we study the cost increase due to multitasking.

2 - Minimizing Total Weighted Completion Time with Unexpected Machine Unavailability

Yumei Huo, Associate Professor, CUNY at Staten Island, Staten Island, NY, 10314, United States of America, yumei.huo@csi.cuny.edu, Hairong Zhao, Boris Reznichenko

We study the problem of minimizing total weighted completion time on a single machine without any knowledge about the unavailable interval due to breakdown or emergent jobs. For both breakdown model and emergent job model, we show the lowerbounds for any online algorithms, the tight competitive ratios of LPT algorithm, and the tight approximation ratios of First Fit LPT for offline case. Finally, our experimental results show that in practice, both LPT and FF- LPT perform very well.

3 - Bi-Criteria Scheduling on Parallel Machines with Machine Costs

Michael Pinedo, Professor and Chair, New York University, Stern School of Business, 44 West 4th Street, New York, NY, 10012, United States of America, mpinedo@stern.nyu.edu, Joseph Leung, Kangbok Lee

We consider parallel machine scheduling problems where the processing of the jobs involves two types of costs. The first type is one of the classical scheduling objectives (i.e., makespan, flow time). The second type is an actual cost of processing a specific job on a specific machine. We present an overview of all the complexities of all problems considered in this bi-criteria scheduling framework.

4 - Throughput Optimization for Epicyclic Cycle in Dual-Gripper Robotic Cells under a Circular Layout

Kyung Sung Jung, PhD Candidate, University of Texas at Dallas, Jindal School of Management, 800 W Campbell Rd., SM30, Richardson, TX, 75083, United States of America, kxj083000@utdallas.edu, Michael Pinedo, Chelliah Sriskandarajah, Neil Geismar

We consider the problem of scheduling operations to find the optimum k-unit cyclic sequence of robot movements in a dual-gripper bufferless robotic cell under circular layout, free-pickup criterion and the additive-travel-time metric. Given a small swithcing time for grippers , Epicyclic cycle proivdes a 3/2-approximation to the optimum cycle time.

5 - Fast Approximation Schemes for Scheduling Problems Related to Positive Convex Half-Product

Hans Kellerer, Professor, Universitat Graz, Statistik and Operations Research, Universitatstrabe 15, A-8010, Graz, Austria, hans.kellerer@uni-graz.at, Vitaly Strusevich

We address a version of the Half-Product Problem and its restricted version with a linear knapsack constraint. We focus on the development of fully polynomial-time approximation schemes with running times that depend quadratically on the number of variables. Applications to various scheduling problems are reported.

■ MA15

15- West 202- CC

Software Demonstration

Invited Session

1 - DPL Even Easier from Excel!

Chris Dalton,CEO, Syncopation Software, 6 State Street, Suite 402, Bangor ME 04401, United States of America, cdalton@syncopation.com

The power of DPL comes to a cell near you! With DPL 8's new Excel add-in interface, key modelling and analysis features are right in front of you while you build your spreadsheet. Utilize decision trees, influence diagrams and Monte Carlo simulation in an intuitive environment. With DPL's unique, insightful outputs in Microsoft Office native formats, you can quickly analyze, format, tweak, copy and paste to create the ultimate PowerPoint presentation!

2 - LINDO Systems, Inc. - Optimization Modeling Made Easy

Mark Wiley,VP Marketing, Lindo Systems, Inc., 1415 North Dayton, Chicago IL 60604, United States of America, mwiley@lindo.com. Gautier Laude

See the new LINDO API, LINGO and What'sBest! with enhancements to the linear, integer, stochastic, NLP and global solvers to exploit multicore hardware. Learn how easy it is to: (1) quickly build complex optimization models; (2) effortlessly access data in Excel and databases; and (3) seamlessly embed optimization into your own applications.

■ MA16

16- West 207- CC

Some Simplifying Conditions for Markov Chain Modeling

Cluster: Tutorials

Invited Session

Chair: Marlin Thomas, Airforce Institute of Technology, Graduate School of Engineering & Managem, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States of America, marlin.thomas@afit.edu

1 - Some Simplifying Conditions for Markov Chain Modeling

Marlin Thomas, Airforce Institute of Technology, Graduate School of Engineering & Managem, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States of America, marlin.thomas@afit.edu

Under certain lumpability conditions the state space of a Markov chain can be partitioned into selected subsets of states to form a smaller chain that retains the Markov property, thus providing even greater simplicity in modeling operational systems. In this presentation we will discuss methods for construction lumped chains and their application. Examples will be provided for manpower planning and DNA testing applications.

■ MA17

17- West 208 B- CC

Case Competition I

Sponsor: INFORM-ED

Sponsored Session

Chair: Palaniappa Krishnan, Associate Professor, University of Delaware, Applied Econ & Statistics, Townsend Hall, 531 S. College Avenue, Newark, DE, 19716, United States of America, baba@udel.edu

1 - Predicting ATM Transactions at IS Bank

Gokhan Ceyhan, Research Assistant, Middle East Technical University, Department of Industrial Engineering, Ankara, 06800, Turkey, gokhanceyhan01@gmail.com, Murat Koksalan, Gülser Köksal, Sinem Mutlu, Sahan Yildiz, Sinan Gurel

Automated teller machines (ATMs) provide convenience to bank customers as they are widely spread out geographically and they, 24/7, offer most of the services that can be done at a branch of a bank. The operational cost of providing a service at an ATM is much lower than that of providing the same service by a bank teller. Furthermore, the initial cost of installing an ATM is reasonable. These facts make ATMs an important alternative channel for the bank branches. The main objective of this case study is to help students improve their empirical modeling, analysis, and decision support skills. It is designed to help students understand how regression models should be developed and used to support decisions under uncertainty.

2 - Patient Experience Improvement at UPMC Eye Center
Tinglong Dai, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15217, United States of America, dai@cmu.edu, Sridhar Tayur, Joshua Rheinbolt, Robert Noecker

In this case, we describe a patient improvement initiative at University of Pittsburgh Medical Center (UPMC) Eye Center, where both long waiting times and equipment underutilization were observed. The improvement project featured a videotaping of the service process in the UPMC Eye Center's imaging room for an extended period. Based on analyzing the videos, the researchers at Carnegie Mellon University's Tepper School of Business, together with the physicians at UPMC Eye Center, proposed a simple "dome-shaped" strategy that used different appointment interval before, during, and after the lunchtime, and determined the optimal service parameters using queueing network modeling and simulation analysis. Students learn through this case how to address a real-life service design problem through detailed observation, quantitative modeling, and simulation. They are also taught how to make recommendations matching the needs and the expectations of real service environments. This case is intended for both undergraduate and MBA students in operations management, service management, or healthcare analysis courses, as well as health professionals who are interested in improving the efficiencies in their workplaces.

■ MA18

18- West 208 A- CC

Simulation Applications

Contributed Session

Chair: Dong Xu, Research Assistant, University of Arizona, SIE Dept (Rm 111), Old Engr Bldg, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, dongxu@email.arizona.edu

1 - An Agent-based Simulation of New Product Adoption and Subsequent Purchases
Christian Stummer, Professor, Bielefeld University, Universitaetsstr. 25, Bielefeld, 33615, Germany, christian.stummer@uni-bielefeld.de, Elmar Kiesling, Markus Guenther, Rudolf Vetschera, Lea M. Wakolbinger

Market success of innovations requires not only sufficient adoption rates, but also repurchases. We describe an agent-based simulation model for the market introduction of a novel convenience good, which takes these aspects into account. It considers heterogeneous consumers with individual preferences in a geographically distributed network and explicitly models consumer learning of product characteristics by means of social interaction, first-hand experience, and vendor's mass communication.

2 - Simulation & Analysis of the Layout of a Company with High Variability in the Manufacturing Processs
Alejandro G. del Valle, Professor, University of A Coruna, Faculty of Engineering, Av Mendizabal s/n, Ferrol, 15403, Spain, agvalle@udc.es, Diego Crespo Pereira, David del Rio Vilas, Javier Faulin

The manufacturing process of a slate manufacturer is characterized by a high variability because the slate is a natural product. In this paper we make a simulation of the manufacturing process to obtain and analyze a new plant layout. The analysis is performed using the data obtained with the simulation model as inputs of a time series model. The results show unequivocally that the new layout counteracts the effects of the variability, increasing the plant productivity.

3 - The Effect of Population Dynamics and Network Configuration on Social Services Provision
Oscar Herrera-Restrepo, PhD Student-Industrial and Systems Engineering, Virginia Polytechnic Institute and State University, 1000 Houndschase Lane NW Ap 1B, Blacksburg, VA, 24060, United States of America, oscar.herrera@upr.edu, Alexandra Medina-Borja

The development of an agent-based simulation model depicting the co-evolution of social services networks helped us understand how population dynamics and initial network configuration affect the number of services provided. This work contributes to the body of knowledge of organizational design through the implementation of system engineering tools.

4 - Hybrid Simulation-based Duopoly Game Platform and Analysis for Supply Chain and Marketing Activities
Dong Xu, Research Assistant, University of Arizona, SIE Dept. (Rm 111), Old Engr Bldg, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, dongxu@email.arizona.edu, Chao Meng, Young-Jun Son

A hybrid simulation-based game platform involving agent-based modeling and system dynamics is proposed for analyzing integrated supply chain and marketing under a duopoly environment. To resolve the simulation-based game, an innovative empirical game analysis procedure is devised, where major components are in strategy exploration, payoff generation, game solving, and equilibrium quality assessment. Preliminary results demonstrated benefits of the proposed game platform and analysis procedure.

5 - A Comparison of IAOR and Google Scholar Literature Retrieval
K. Preston White, Jr., Professor, University of Virginia, Department of Systems and Info Engr, P.O. Box 400747, Charlottesville, VA, 22904-4747, United States of America, kpwhite@virginia.edu, Lawrence Bonczar

As an INFORMS member, you receive a subscription to IOAR Online, a searchable version of the IFORS journal International Abstracts in Operations Research. The unique objective of IAOR is to index all OR journal articles. We present an empirical study that compares IAOR and Google Scholar as search engines for locating articles on a specific OR topicósimulation applications in healthcare. Returns are scored based on precision and recall; search results are shown to be complimentary.

■ MA19

19- West 211 A- CC

Scheduling Surgeries and Proton Therapy Facilities

Contributed Session

Chair: Chase Rainwater, Assistant Professor, INEG Department, University of Arkansas, Fayetteville, AR, 72701, United States of America, cer@uark.edu

1 - Operating Room Scheduling Considering PACU
Camilo Mancilla, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States of America, cam306@lehigh.edu, Robert Storer

We developed algorithms to find starting times for surgeries in mutliple ORs. We modeled this problem using stochastic integer programming. We provide approximate algorithms to solve this problem and also a brief computational study.

2 - How to Schedule Patients within Their Due Time
Michael Samudra, KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, mihaly.samudra@econ.kuleuven.be, Brecht Cardoen, Erik Demeulemeester

We deal with a real life problem found at the Belgian hospital UZ Leuven, where elective patients are assigned to a surgery date given a medical criterion called due time. The criterion defines the latest time at which a surgery of a given pathology is to be performed. Firstly, given the hospital's a priory estimated surgery durations and realized schedule, the current practice is quantitatively evaluated. Secondly, alternative methods are proposed and compared to the current practice.

3 - Patient Scheduling in a Proton Therapy Facility: An MDP Modeling Approach
Ridvan Gedik, Graduate Assistant, INEG Department, University of Arkansas, Fayetteville, AR, 72701, United States of America, rgedik@uark.edu, Shengfan Zhang, Chase Rainwater

A new consideration in proton therapy treatment planning is the requirement that the mix of patients satisfy desired percentages. Deviations from patient mix preferences and their impacts on operational capabilities are of particular interest to healthcare planners. We propose a Markov decision process (MDP) model for multi-category patient scheduling that determines the best admission decisions while maximizing the number of fractions and minimizing the deviations from the desired patient mix.

4 - A Hybrid Approach to Solve Operational Level Patient Scheduling in a Proton Therapy Facility
Chase Rainwater, Assistant Professor, INEG Department, University of Arkansas, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Ridvan Gedik

This research examines the impact of incorporating long term patient mix preferences and treatment side constraints on operational level patient scheduling decisions in a proton therapy facility. The advantages and disadvantages of modeling certain aspects of the scheduling problem using constraint programming versus integer linear programming are demonstrated. Preliminary results of a hybrid modeling approach and the consequences of deviating from the desired patient mix are discussed.

■ MA20

20- West 211 B- CC

George B. Dantzig Dissertation Prize I

Cluster: George B. Dantzig Dissertation Prize

Invited Session

Chair: Aliza R. Heching, IBM TJ Watson Research Center, Mathematical Sciences, Yorktown Heights, NY, 10598, United States of America, ahechi@us.ibm.com

1 - George B. Dantzig Dissertation Prize

Aliza R. Heching, IBM TJ Watson Research Center, Mathematical Sciences, Yorktown Heights, NY, 10598, United States of America, ahechi@us.ibm.com

The George B. Dantzig Disseration Award recognizes dissertations that are relevant to the practice of operations research and the management sciences. The award is designed to support greater interaction between academia and the world of practice by awarding research that combines development of novel methodology and new techniques with creative application in a practical real-world setting. Problem scope and potential magnitude of impact of research are considered. In this session, the award finalists will present their research.

■ MA21

21- West 212 A- CC

Network Flows

Sponsor: Optimization/Networks

Sponsored Session

Chair: James Orlin, Professor, Massachusetts Institute of Technology, E62-570, Cambridge, MA, 02139, United States of America, jorlin@mit.edu

1 - A Self-Organizing (Ghost Image) Algorithm for Fixed-Charge Network Flows

Richard Barr, Southern Methodist University, P.O. Box 750123, 333 Caruth Hall, Dallas, TX, 75275-0123, United States of America, barr@smu.edu, M. Mehdi Amini, Fred Glover, Gary Kochenberger

We propose a new self-organizing algorithm for fixed-charge network flow problems based on ghost-image processes. Our algorithm iteratively modifies an idealized representation of the problem embodied in a self-organizing ghost image, enabling all steps to be performed with a primal network flow algorithm. Extensive computational testing on fixed-charge transportation problems is presented although our algorithm is not specialized to this class.

2 - Interval-flow Generalized Networks: Models and Applications

Angelika Leskovskaya, Southern Methodist University, Department EMIS, Dallas, TX, 75275, United States of America, aleskovs@lyle.smu.edu, Richard Barr

Presented is a new category of network flow models: interval-flow generalized networks, an enhancement of linear generalized networks by conditional lower bounds on some or all of the arcs. Mathematical models, including fixed-charge formulations, and a variety of practical applications are described.

3 - A Polynomial Time Algorithm for Rayleigh Ratio on Discrete Variables

Dorit S Hochbaum, UC Berkeley, Department of IEOR, Berkeley, CA, United States of America, hochbaum@ieor.berkeley.edu

A general form of minimizing the Rayleigh ratio on discrete variables is shown here, for the first time, to be polynomial time solvable. This is significant since major problems in clustering, partitioning and imaging can be presented as the Rayleigh ratio minimization on discrete variables and an orthogonality constraint. When the discreteness constraints are relaxed, the problems can be solved using the "spectral technique". The discrete relaxation is shown to be more efficient than the spectral method, and in practice delivering better quality solutions.

4 - Solving Maximum Flows in O(nm) Time, and Less

James Orlin, Professor, Massachusetts Institute of Technology, E62-570, Cambridge, MA, 02139, United States of America, jorlin@mit.edu

Over the past 30 years, researchers have developed successively faster algorithms for the maximum flow problem. The best strongly polynomial time algorithms have come very close to O(nm) time. Many researchers have conjectured that O(nm) time is the "true" best running time. We resolve the issue in two ways. First, we show how to solve the max flow problem in O(nm) time. Second, we show that the running time is even better if m = O(n). In this case, the running time is O(n^2 / log n).

■ MA22

22- West 212 B- CC

Generic Branch-and-Price Solvers

Sponsor: Computing Society

Sponsored Session

Chair: Gerald Gamrath, Research Assistant, Zuse-Institut Berlin, Takustr 7, Berlin, 14199, Germany, gamrath@zib.de

1 - GCG 1.0 – A Generic Branch-cut-and-price Solver

Gerald Gamrath, Research Assistant, Zuse-Institut Berlin, Takustr 7, Berlin, 14199, Germany, gamrath@zib.de, Martin Bergner, Marco Lübbecke, Christian Puchert

We implemented GCG, a branch-cut-and-price solver based on the branch-cut-and-price framework SCIP. Given a MIP, GCG performs a Dantzig-Wolfe reformulation (based on user input, or a reformulation suggested by the solver) and does a full branch-cut-and-price search. It inherits advanced MIP solving features from SCIP, extended by plugins using both the original and the extended formulation. We report on our computational experiments and discuss what can be learned from a generic solver.

2 - Dip and DipPy: Towards a Generic Decomposition-based MIP Solver

Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Matthew Galati, Jiadong Wang

DIP is a software framework for simplifying the implementation of a range of decomposition-based algorithms for solving mixed integer linear optimization problems. Recent development has focused on the implementation of a generic decomposition-based solver, capable of either automatically detecting block structure or exploiting structure identified by the user through a Python-based modeling language called DipPy. We present the latest developments and computational results with the framework.

3 - The New Decomposition Solver in SAS/OR

Matthew Galati, SAS Institute, 100 SAS Campus Drive, Cary, NC, United States of America, matthew.galati@sas.com

This talk demonstrates the new DECOMP feature in SAS/OR for using decomposition-based techniques for solving MILPs. OPTMODEL allows a user to easily experiment with different decompositions simply by defining the partition of constraints in the original space. We discuss the overall design motivated by a goal to minimize user burden and reduce the need for algorithmic expertise. We present results from client applications, including those in shared and distributed memory parallel environments.

4 - Acceleration and Stabilization Techniques for Column Generation applied in Workforce Planning Models

Alper Uygur, Sr. Operations Research Specialist, BNSF Railway, 2400 Western Center Blvd, TOB TS-464, Fort Worth, TX, 76131, United States of America, alper.uygur@bnsf.com, George Wilson, Matthew Galati

This research presents an acceleration and stabilization methodology for solving large Workforce Planning Problems with Cross-Training, using the Likelihood of Assignment heuristic and Column Generation (in DIP). To alleviate the Heading-In Effect, strategies for constructing the initial dual vector are provided. Dual vectors from RMPs at any iteration are further manipulated to prevent astray columns which cause stalling. A subproblem selection routine is proposed to accelerate the convergence.

■ MA23

23- West 212 C- CC

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS, The Practice Section

Invited Session

Chair: Allen Butler, Daniel H. Wagner Associates, 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - A Deployed Quantal Response Based Patrol Planning System for the US Coast Guard

Bo An, University of Southern California, Los Angeles, CA, United States of America, boa@usc.edu, Fernando Ordonez, Milind Tambe, Eric Shieh, Rong Yang, Craig Baldwin, Joseph DiRenzo, Ben Maule, Garrett Meyer

In this paper we describe the model, theory developed and deployment of PROTECT, a game-theoretic system in use by the United States Coast Guard (USCG) in the Port of Boston for scheduling patrols. The PROTECT system is premised on an attacker-defender Stackelberg game model but its development and implementation required both theoretical contributions and detailed evaluations. The USCG evaluated the deployment of PROTECT in the Port of Boston as a success and is currently evaluating the system in the Port of New York, with the potential for nationwide deployment.

2 - The Philadelphia Districting Contest: Designing Territories for City Council Based Upon the 2010 Census

Frederic Murphy, Professor, Temple University, Alter Hall 435, Philadelphia, PA, 19122, United States of America, fmurphy@temple.edu, Ram Gopalan, Steven Kimbrough, Nicholas Quintus

The City of Philadelphia recently redesigned the districts for its council members using the 2010 census. Several public interest groups organized a districting contest to increase public engagement and offer examples of City Council districts that minimized gerrymandering. We developed methodologies that allowed us to win in one contest category and make presentations before City Council. We describe the events surrounding the districting process, the methodologies we developed and the influence that the contest ultimately had on the design of city council districts.

■ MA24

24- West 213 A- CC

Patient Flow

Sponsor: Health Applications Society

Sponsored Session

Chair: Michael Magazine, University of Cincinnati, Dept. of OBA, Cincinnati, OH, 45221, United States of America, Magazim@ucmail.uc.edu

1 - A Universal Appointment Rule for Patient Types, No-shows and Walk-ins

Tugba Cayirli, Assistant Professor, Ozyegin University, Kusbakisi Cad. No. 2, Altunizade-Uskudar, Istanbul, 34662, Turkey, Tugba.Cayirli@ozyegin.edu.tr, Kum Khiong Yang

This study evaluates sequencing approaches that differentiate patient groups by their mean and variance of service times, no-show and walk-in probabilities. Results confirm sequencing improves clinic performance in terms of patient's wait, doctor's idle time and overtime. While it is difficult to generalize the best sequencing policy, our study shows that a proposed universal Dome appointment rule performs consistently well across different clinical scenarios and cost valuations.

2 - Appointment Scheduling: Implementing Patients Flow Policies

Linda LaGanga, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, United States of America, Linda.Laganga@MHCD.org, Wes Williams, Michele Samorani, Stephen Lawrence

We present our evolving research and implementation of scheduling policies that improve patient flow. Our models consider the value of serving more patients sooner and the impacts of uncertainty and variability on provider utilization, patient wait time, and provider productivity. We will present the solutions we have implemented and innovations we are piloting, and discuss how to develop and implement scheduling practices and sustain positive service delivery experiences.

3 - Resilient Patient Scheduling in Complex Outpatient Clinics

Elham Torabi, PhD Student, University of Cincinnati, 2925 Campus Green Dr., OBAIS Department, Cincinnati, OH, 45221, United States of America, torabiem@mail.uc.edu, Craig Froehle, Uday Rao

Complex clinics involve multiple care providers, so coping with operational disruptions can be challenging. We develop stochastic optimization models for patient scheduling with uncertain clinical task durations, minimizing clinic duration and patient waits. We consider several different assumptions about task durations and test each model's resilience to disruption via discrete-event simulation.

4 - Dynamic Prioritization for Emergency Physicians

Yann Ferrand, Assistant Professor, Clemson University, Department of Management, Sirrine Hall, Clemson, SC, 29634, United States of America, yferran@clemson.edu, Michael Magazine, Uday Rao, Todd Glass

To improve patient flow in an emergency department, we investigate a novel way to prioritize patients, by augmenting current prioritization practices with a consideration of actual time spent in the system. We use discrete event simulation to measure the performance of this approach in terms of patient wait time and length of stay, and compare it to the current practice at a specific emergency department.

■ MA25

25- West 213 B- CC

Joint Session HAS/SPPSN: Resource Allocation in Screening and Treatment Decisions

Sponsor: Health Applications Society & Public Programs, Service and Needs

Sponsored Session

Chair: Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Ave, 2783 IOE, Ann Arbor, MI, 48109, United States of America, lavieri@umich.edu

1 - Optimizing Differential Blood Screening Assays to Reduce Transfusion Risk

Ebru Bish, Associate Professor, Virginia Tech, Dept. of Industrial and Systems Engg, Blacksburg, VA, 24061-0118, United States of America, ebru@vt.edu, Susan Stramer, Douglas Bish, Ryan Xie

We study the problem of selecting screening tests, from a set of FDA-approved tests, to detect infectious agents in donated red blood so as to minimize the probability of an adverse transfusion event. The tests are imperfectly reliable, and are characterized in terms of their specifity and sensitivity. We focus on policies that allow for differential testing, characterize the structure of an optimal solution, propose an effective algorithm, and provide insights based on real data.

2 - Simulation Optimization of the Screening and Treatment Decisions for Prostate Cancer

Daniel Underwood, North Carolina State University, 111 Lampe Drive, 373 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, daniel.underwood@ncsu.edu, Jingyu Zhang, Brian Denton

We present a simulation-optimization model for finding near optimal strategies for prostate cancer screening, including decisions related to screening by prostate-specific antigen (PSA) and treatment by radical prostatectomy. We discuss a customized implementation of COMPASS for solving our problem. Results from the COMPASS algorithm are compared to results from a previously published method based on a genetic algorithm. We present results, based on longitudinal data for a large North American population, to study the influence of personalized risk factors on individualized PSA-based screening policies.

3 - HIV Models: Contraception and Extended High Viremics

Benjamin Armbruster, Assistant Professor, Northwestern University, Evanston, IL, 60208, United States of America, armbruster@northwestern.edu

We discuss two issues about HIV in Africa. First, hormonal contraceptives are very common have recently been shown to double the risk of HIV. We look at the births, HIV transmission, and mother-to-child transmission under various scenarios of contraceptive substitution. Second, a fraction of HIV-1 type C infections have high viral loads for an extended duration. These individuals are more infectious and have a shorter life span. We discuss their impact on the HIV epidemic.

4 - Screening for Hepatocellular Carcinoma: An Application of Dynamic Allocation Indices

Elliot Lee, Doctoral Pre-Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, elliot.dy.lee@gmail.com, Michael Volk, Mariel Lavieri

The problem of allocating a fixed screening capacity amongst a set of patients at risk for hepatocellular carcinoma is modeled in the language of the multi-armed bandit problem. While the current screening protocol uses fixed intervals, the policy proposed here incorporates individual patient information which is gathered sequentially over time. An expression for the allocation index is derived, and the policy's performance is tested on surveillance data on 1025 patients followed over 5.3 years.

■ MA26

26- North 221 A- CC

Sustainability in the Supply Chain

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

1 - Fair and Efficient Implementation of Collective Extended Producer Responsibility Legislation

Luyi Gui, Georgia Institute of Technology, Atlanta, GA, United States of America, luyi.gui@gatech.edu, Atalay Atasu, Beril Toktay, Ozlem Ergun

Extended Producer Responsibility is a policy tool that holds producers financially responsible for the post-use handling of their products. EPR implementations are typically collective - a large collection and recycling network handles multiple producers' products; total cost is then allocated to producers proportionally such as by return share. In this paper, we study the design of fair cost allocation mechanisms for collective EPR by adjusting the widely used return share allocation.

2 - How Cooperative can Firms be in Green Production?

Fang Tian, PhD. Student, University of Southern California, 2723 S Hoover St., Apt 4, Los Angeles, CA, 90007, United States of America, tianfang@usc.edu, Greys Sosic, Laurens Debo

As the growth in volume and complexity of consumer products, the end-of-life disposal has become a societal problem. Regarding to different products, we studied responsibilities of the government and manufacturers, identified the optimal/stable market structure to implement recycling. Our research balances the fixed cost constructing inverse channels and variable cost recycling products, and provides legislators suggestions on planning recycling schemes to pursue the optimal social welfare.

3 - The Dynamics of Electric Vehicle Adoption Systems

Buket Avci, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, buket.avci@insead.edu, Karan Girotra, Serguei Netessine

We analyze the dynamics of electric vehicle adoption decision in a market where customers are offered different ownership structures (purchasing miles vs. purchasing batteries). We compare these ownership structures in terms of market adoption and environmental impact. We also investigate how the changes in future gasoline and electricity prices and the advances in battery technology influence the dynamics of electric vehicle adoption.

4 - Greening Suppliers with Private Information

Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

A successful sustainability initiative run by a manufacturer requires active participation by its suppliers. Given that such an initiative may force the suppliers to reveal their cost structure and other proprietary information, however, they may be unwilling to fully cooperate or try to free ride on other suppliers' efforts. We examine these incentive issues by building a model based on information disclosure literature.

■ MA27

27- North 221 B- CC

OR Applications in the Agri-Food Supply Chain

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Rene Villalobos, Arizona State University, 699 Mill Avenue, Tempe, AZ, 85281, United States of America, rene.villalobos@asu.edu

1 - A Supply Chain Optimization Model for Perishable Goods with Quality Dependent Value

Nicholas Mason, Student, Arizona State University, University Drive and Mill Avenue, Tempe, AZ, 85287, United States of America, anmason@asu.edu, Omar Ahumada, Rene Villalobos

Perishability, seasonality and non-uniform product quality make the sourcing and distribution of fresh agricultural products a challenging task. We therefore propose a mixed integer programming model that captures product perishability using discrete quality states, with a value function that is not strictly decreasing. We model product degradation during storage and transportation as well as quality distribution of products at purchase in a three tier food supply chain.

2 - Efficiency and Sustainability in the Food Service Supply Chain

Renzo Akkerman, Technical University of Denmark, Department of Management Engineering, Produktionstorvet 424, Kgs. Lyngby (Copenhagen), 2800, Denmark, renzo@dtu.dk, Martin Grunow, Yang Wang

The food service sector often uses industrially prepared meal elements in the preparation of meals. This presentation deals with the temperature-controlled production and distribution of these meal elements. The focus will be on the planning problems and on its sustainability assessment. This involves the inclusion of changing product temperature in planning decisions, and the integration of these planning decisions in sustainability assessment.

3 - OR Challenges in the Wine Supply Chain

Alejandro Mac Cawley, Georgia Tech, 765 Ferst Dr., NW, Atlanta, GA, 30332, United States of America, amac@gatech.edu, John Bartholdi

The international supply chains for wine are complex. Wine is a highly branded product produced in a few countries and shipped thousands of miles to consumers. Furthermore, there is a limited supply and at least one large consumer, the US, legally restricts distribution through a three-tier system. We will describe some OR challenges in this supply chain, from the winery to the importer, the distributor, and the retailer.

4 - Optimal Levels of Temporary Immigrant Force under Local Farm Labor Shortages

Hector Flores, Dean of Sciences and Mathematics, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, hector.flores@asu.edu, Gustavo Lujan, Rene Villalobos, Christopher Wishon, Nicholas Mason

Major U.S. agricultural regions have seen an increase in the strictness of immigration enforcement. This has resulted in an important labor gap in an industry highly dependent on migrant farm laborers. The H2A visa allows farmers to bring foreign temporary workers. To get this Visa, farmers need to show that the local labor pool will not be affected by these immigrants. We present optimization models that render optimal levels of immigrant workers that complement the existing local labor force.

■ MA28

28- North 221 C- CC

Competition and Cooperation in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Greys Sosic, University of Southern California, Marshall School of Business, Los Angeles, CA, United States of America, sosic@marshall.usc.edu

1 - Revenue Management with Bargaining

Qi Feng, Krannert School of Management, Purdue University, 100 S. Grant Street, West Lafayette, IN, 47907, United States of America, AnnabelleFeng@Purdue.edu, George Shanthikumar

We analyze the role of bargaining in a firm's revenue management. The firm sells a fixed amount of stock to an arrival stream of potential buyers, who are heterogeneous in their valuation of the product. In addition to dynamically adjusting the posted product price, the firm may also allow for price negotiation with the buyers. We focus on identifying the product characteristics that lead to significant value of incorporating bargaining into firm's revenue management strategy.

2 - Structural Estimation of Callers' Delay Sensitivity in Call Centers under Delay Announcement

Che-Lin Su, University of Chicago Booth School of Business, 5807 S Woodlawn Ave., Chicago, IL, 60637, United States of America, che-lin.su@chicagobooth.edu, Baris Ata, Zeynep Aksin, Seyedmorteza Emadi

We estimate callers' reward and cost parameters from the data of calls made to a call center with delay announcement. We consider the setting in which the call center provider chooses the information level of the announcement messages. We compute the steady state equilibrium of the system under different information levels, and analyze changes in call center performance measures.

3 - Leveraging Quality Information in Stock-outs for Products with Common Value Uncertainty

Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu, Garrett Van Ryzin

When some less-informed consumers are uncertain about a product's quality, stock-outs may convey information about the propensity of other, better-informed consumer to purchase. We explore how a firm and the less-informed consumers can exploit such information during a short sales season.

■ MA29

29- North 222 A- CC

Workforce Management and Planning

Cluster: Workforce Management

Invited Session

Chair: Merav Aharoni, IBM Research- Haifa, Haifa University Campus, Haifa, 31905, Israel, MERAV@il.ibm.com

1 - Challenges in Capacity Planning for Back-office Operations at Contact Centers

Gyana Parija, IBM Research, New Delhi, India, gyana.parija@in.ibm.com

In this talk, we will discuss the modeling challenges faced in defining capacity planning problems for Back-office (Non-voice) Operations at Contact Centers.

2 - Models for the Analysis and Optimization of Workforce Dynamics

Mayank Sharma, Research Director, IBM TJ Watson Research Center, 1099 Kitchawan Rd, Ossining, NY, 10562, United States of America, mxsharma@us.ibm.com, Yingdong Lu, Mark Squillante, Bo Zhang

A fundamental workforce analytics capability concerns the modeling, analysis and optimization of decisions to control workforce dynamics; all of which are quite different from the corresponding problems in traditional supply chains. To address these challenges, we develop models for the evolutionary dynamics of human talent and skill composition, and solve the corresponding stochastic optimization (control) problem based on these models to maximize expected business performance over time.

3 - Robust Project Scheduling at a Large IT Services Delivery Organization

Elvin Coban, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ecoban@andrew.cmu.edu, Aliza R. Heching, J.N. Hooker, Alan Scheller-Wolf

We consider a project scheduling problem at a large IT services delivery organization (SDO) with cross-trained employees, heterogeneous projects, schedule disruptions, and service quality guarantees. Durations of subtasks and disruptions and project arrival times are uncertain. System parameters are estimated using data from the IT SDO. Our goal is to identify an effective scheduling of project subtasks and assignment to each employee, capturing uncertainties in a robust scheduling model.

■ MA30

30- North 222 B- CC

Impact of Financial Flows on Operations

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Wei Luo, Duke University, 100 Fuqua Drive, Durham, United States of America, wei.luo@duke.edu

1 - Trade Credit in Supply Chains: Multiple Creditors and Priority Rules

Song Alex Yang, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, sayang@london.edu, John Birge

Priority rules determine the order of repayment when the debtor cannot repay all of his debt. In this paper, we study how different priority rules influence trade credit usage and supply chain efficiency when multiple creditors are present.

2 - A Comparison and Equilibrium Analysis of Push, Pull, and Trade Credit Contracts

Lingxiu Dong, Associate Professor, Olin Business School, Washington University, One Brookings Drive, Saint Louis, MO, United States of America, dong@wustl.edu, Danko Turcic, Xiaomeng Guo

We consider three types of wholesale price contracts in a supply chain, including push, pull, and trade credit. The research focuses on understanding the implication of those contracts for the allocation of inventory risk among supply chain members, and the driving forces for the equilibrium contractual arrangement in the supply chain.

3 - Balancing Growth and Bankruptcy Risk in a Cash-constrained Firm

Vishal Gaur, Professor, Cornell University, Johnson School, Ithaca, NY, 14853, United States of America, vg77@cornell.edu, Yasin Alan

A cash constrained firm has to balance growth and bankruptcy risk. We study the operational implications of this tradeoff in a finite horizon cash-constrained inventory model with non-stationary demand, which is a function of the firm's past order quantities. We analyze four growth scenarios to capture the impact of financing constraints and the bankruptcy process on the firm's stocking decisions.

4 - Impact of Cash Conversion Cycles on Inventory Systems with Non-stationary Demand

Wei Luo, Duke University, 100 Fuqua Drive, Durham, United States of America, wei.luo@duke.edu, Kevin Shang

We consider a cash-constrained firm that orders inventory to satisfy stochastic customer demand in a finite horizon. The firm provides trade credits to its downstream customer while receiving trade credits from its upstream supplier. The work sheds light on how firms should manage cash conversion cycles and assesses the value of cash flow information.

■ MA31

31- North 222 C- CC

Supply Chain Risk Management

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Zugang Liu, Assistant Professor of Business Administration, Pennsylvania State Hazleton, 76 University Drive, Hazleton, PA, 18202, United States of America, zxl23@psu.edu

1 - Supply Chain with Outsourcing and Quick-response Production under Demand and Cost Uncertainty

Zugang Liu, Assistant Professor of Business Administration, Pennsylvania State Hazleton, 76 University Drive, Hazleton, PA, 18202, United States of America, zxl23@psu.edu, Anna Nagurney

We develop a modeling framework for supply chains with global outsourcing and quick-response production under demand and cost uncertainty. We considers multiple off-shore suppliers, manufacturers, and demand markets. Our results reveal important insights regarding how uncertainty affects the profits, risks, as well as decisions of supply chain firms under competition.

2 - Disruptions and Market Competition on the Supply Chain Network

Renato de Matta, Associate Professor, University of Iowa, 108 PBB, Iowa City, IA, 52241, United States of America, renato-dematta@uiowa.edu

We develop a model to study the effects of disruptions and market competition on the formation of a supply chain and transfer prices. We exploit the natural separation between the material flow and cash allocation decisions utilizing a generalized decomposition scheme to find good feasible solutions to our model. Computational results and managerial insights are presented.

3 - Supply Chain Networks with Corporate Financial Risks and Trade Credits under Economic Uncertainty

Jose Cruz, Associate Professor, University of Connecticut, School of Business, Storrs, CT, 06269, United States of America, jose.cruz@business.uconn.edu, Zugang Liu

This paper provides a framework to investigate how financial risks affect the values of interconnected supply chain firms' profitability, as well as, the cash and credit transactions. From a network perspective, we develop a variational inequality equilibrium model in conjunction with capital asset pricing model and the net present value to determine the optimal supply chain prices, profits, and implicit equity values of supply chain firms under financial risks and economic uncertainty.

■ MA32

32- North 223- CC

Topics in Manufacturing II

Contributed Session

Chair: Chrissoleon Papadopoulos, Professor, Aristotle University of Thessaloniki, Department of Economics, Panepistimiopolis, Thessaloniki, GR 541 24, Greece, chrissoleon.papadopoulos@gmail.com

1 - Robust Manufacturing Line Design with Controlled Buffer Times to Manage Stochastic Inter-task Times

Ehsan Nazarian, PhD Candidate, University of Nebraska-Lincoln, 361 WSEC, Lincoln, NE, 68588, United States of America, ehsan.nazarian@huskers.unl.edu, Jeonghan Ko

This paper proposes a new approach for moderately robust manufacturing line design with uncertainties in task and inter-task times. A new interpretation of the nonproductive times in stations is presented introducing the concept of a-fractal buffer time to manage the manufacturing time uncertainties with controlled robustness. The effect of uncertainties and conservatism level on the cycle time is analyzed to determine the effective buffer time assignment in stations without excessive idle time.

2 - Cognitive Workload Evaluation: An Application in an Automative Company

Tugba Sen, Anadolu University, Department of Industrial Engineering Fac, Anadolu University, Eskisehir, 26555, Turkey, sentugba@hotmail.com, Zakir Poyraz, Ilgin Poyraz Acar

In this study the effects of cognitive workload on the industrial accidents in an automotive company were examined. Cognitive workload for two different employee groups was evaluated by using the NASA-TLX method. Relationship between cognitive workload and dependent variables were examined by multiple regression analysis and results were evaluated.

3 - A Framework for Developing Manufacturing Ontologies in Distributed Enterprises

Peter Chhim, Wayne State University, 5401 Cass Avenue, Detroit, Mi, 48202, United States of America, pchhim@wayne.edu, Ratna Babu Chinnam

As markets continue to globalize, organizations find themselves stretched across geographical bounds without having effectively captured or conveyed manufacturing knowledge. A tool gaining popularity in providing a common understanding of domains is an ontology. Ontologies are defined as formal, explicit specifications of shared conceptualizations. This research defines a framework for the development and deployment of manufacturing ontologies for distributed enterprises.

4 - New Method to Analyze Production Lines with Unreliable Machines and Finite Buffers

Yassine Ouazene, Mr, Universitè de Technologie de Troyes, 12 rue Marie Curie, Troyes, 10010, France, yassine.ouazene@utt.fr, Chehade Hicham, Yalaoui Farouk, Yalaoui Alice

We present a new analytical formulation to evaluate the system throughput of a buffered serial production line. The machines are unreliable and both failure and repair rates are assumed to be exponentially distributed. The proposed method is based on the analysis of the different states of each buffer using birth-death Markov processes. Then, each original machine is replaced by an equivalent one free from blockage and starvation.

5 - A Neural Network Based Decision Support System for Solving the BAP in Production Lines

Chrissoleon Papadopoulos, Professor, Aristotle University of Thessaloniki, Department of Economics, Panepistimiopolis, Thessaloniki, GR 541 24, Greece, chrissoleon.papadopoulos@gmail.com, Athanasios Tsadiras, Michael E.J. O'Kelly

A Neural Network System (NNS) is presented that solves the buffer allocation problem (BAP) not by the application of search algorithms but by predicting the outcome. To develop this NNS, a large number of training data was needed. This training data was created by using a fast Myopic search algorithm for 9360 different production lines. The high performance of the proposed NNS, both in time and accuracy, makes it a useful tool for the production line designers.

■ MA33

33- North 224 A- CC

Innovations in Sustainable Operations

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations

Sponsored Session

Chair: Michael Galbreth, Associate Professor, Moore School of Business, University of South Carolina, 1705 College St, Columbia, SC, 29208, United States of America, galbreth@moore.sc.edu

1 - Process Innovation and Competition in an Industrial Symbiotic System

Yunxia Zhu, University of Texas-Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, yunxia.zhu@utdallas.edu, Milind Dawande, Srinagesh Gavirneni, Vaidy Jayaraman

Inspired by a real-world example of a paper-sugar symbiotic complex, we study the impact on a firm's operational decisions from implementing an industrial symbiotic system. Our models capture both supply- and demand-side influences of implementation. We characterize the firm's optimal/equilibrium decisions, both in the presence and absence of the system, under monopoly as well as under Cournot competition. Our focus is on understanding the firm's "willingness" to implement the symbiotic system.

2 - Capacity Investment Decisions with Multiple Competing Technologies: A Portfolio Approach

Gilvan Souza, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, gsouza@indiana.edu, Wenbin Wang, Mark Ferguson, Shanshan Hu

We consider investments in sustainable technologies, which require a higher investment but have lower operating (fuel) cost. Savings fluctuate due to uncertain fuel prices, and the technology is not always utilized at 100% due to demand fluctuations. We provide structural and numerical results about technology choice and corresponding investment levels.

3 - Sales Force Incentives for New and Remanufactured Products

Jeremy Kovach, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Jeremy.Kovach@mgt.gatech.edu, Sumitro Banerjee, Atalay Atasu

Firms are increasingly offering remanufactured products alongside new products in the same market. We develop optimal sales force incentives for a single sales agent responsible for new and remanufactured products as well as for separate sales agents responsible for each of the products. Furthermore, we investigate how these compensation schemes change depending on the organizational structure, perceived quality of remanufactured products, demand uncertainty, and sales agent risk aversion.

4 - EPR for Pharmaceuticals

Isil Alev, Georgia Institute of Technology, Atlanta, GA, United States of America, isilalev@gatech.edu, Atalay Atasu, Ozlem Ergun, Beril Toktay

With increased concerns about the environment and public health, managing pharmaceutical overage through take-back programs is gaining popularity. In this work, we consider a game-theoretic model focusing on the interactions between manufacturers, physicians, and patients to investigate the effectiveness of extended producer responsibility in improving stakeholder welfare in this context.

■ MA34

34 – North 224 B – CC

NPD Deep Dive Session

Cluster New Product Development

Invited Session

Chair: Sreekumar Bhaskaran, Southern Methodist University, Cox School of Business, PO Box 750333, Dallas TX 75275, United States of America, sbhaskar@mail.cox.smu.edu

1- Quality Consciousness, Perceived Value and Product Design

Sreekumar Bhaskaran, Southern Methodist University, Cox School of Business, PO Box 750333, Dallas TX 75275, United States of America, sbhaskar@mail.cox.smu.edu, Priyali Rajagopal, Karthik Ramachandran

Research in economics and marketing assumes that quality consciousness consumers will be willing to pay more than low quality consciousness consumers for any given level of quality. We invalidate this assumption by demonstrating that there is a threshold of acceptable quality below which consumers who are highly quality conscious may in fact be willing to pay less than consumers whose quality consciousness is lower. Implications of our findings on product line design are investigated.

■ MA35

35- North 225 A- CC

Non-Traditional Applications of Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Nishant Mishra, Assistant Professor of Operations Management, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, nmishra@rsm.nl

1 - Time-dependent Bid Prices for the Network Revenue Management Problem with Customer Choice Behavior

Marco Bijvank, Rotterdam School of Management, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, mbijvank@rsm.nl, Alwin Haensel

One of the main issues in revenue management involves deciding which products to offer customers during the booking horizon in order to maximize revenue. We develop new efficient mathematical programming methods to compute bid prices, where we include two trends: customers request products according to a general choice model with overlapping consideration sets and bid prices change over time. Another advantage of our formulation is that it uses the appealing simplicity of DLP.

2 - Revenue Management in Inland Container Transport

Nishant Mishra, Assistant Professor of Operations Management, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, nmishra@rsm.nl

We consider the application of revenue management in the inland transport of shipping containers, and show how the problem setting differs from the traditional airline network revenue management problem. We formulate a dynamic optimization model to support accept/ reject decisions for the various types of transportation products, and also discuss possible extensions of this model.

3 - Dynamic Pricing and Inventory Management under Price-and-Inventory Sensitive Demand

Renyu (Philip) Zhang, Ph. D. Student, Olin Business School, Washington University in St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130, United States of America, renyu.zhang@wustl.edu, Nan Yang

We analyze a periodic review pricing and inventory management problem where demand is negatively correlated with both leftover inventory and price. We show that an order-up-to, dispose-down-to, list price policy is optimal. The inventory sensitivity effect contributes to decreased price and inventory levels. Such decrease will be intensified by higher demand sensitivity and dampened if the firm applies the inventory withholding policy.

4 - Frenemies: Price Competition between Codesharing Airlines

Sandra Transchel, Kuehne Logistics University, Brooktorkai 20, Hamburg, 20457, Germany, sandra.transchel@the-klu.org, Robert Shumsky

We study two codesharing airlines that operate flight legs between the same origin and destination. The airlines are competing for customers but are also cooperating by selling tickets on each others' flights. We formulate a closed-loop dynamic game under which each airline dynamically adjusts the prices for its own as well as for the partner's seats. We examine the effectiveness of various transfer fee schemes and the effects of those schemes on the airlines' pricing.

■ MA36

36- North 225 B- CC

Stochastic Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Yihua Li, Disney, Orlando, FL, United States of America, Yihua.Li@disney.com

Co-Chair: Bruce Wang, Professor, Texas A&M University, College Station, TX, United States of America, bwang@tamu.edu

1 - Stochastic Model for Revenue Management with Upgrading and Group Booking

Bruce Wang, Professor, Texas A&M University, College Station, TX, United States of America, bwang@tamu.edu, Yihua Li, Luz A. Caudillo-Fuentesa

Most published Revenue Management models handle Room Upgrading (RU) and Group Bookings (GB) separately from the general Revenue Management problem. This leads to a sub-optimal solution. In this paper, we will build a DLP model together with RU and GB which will make capacities and demands non-independent but crossing room categories. Then we extend our DLP model to a stochastic model (SLP) to counter all uncertainties. Traditional SLP with dynamic programming (DP) is not solvable for most realistic networks because of the large dimensionality of the state space (e.g., typical numbers for even a modest-sized hotel with hundreds of thousands products and for each product DP will go along each of stages = 180-500, each unit of capacities = 500-3000, each of time slots = 500 – 10000, leading to at least 10100 states). Moreover, DP cannot directly deal with RU and GB. We will develop a stochastic model which is solvable together with RU and GB. We accomplish solving it in real time by suggesting a heuristic that generates a good initial feasible solution.

2 - A Metaheuristic for a Territory Design Problem under Stochastic Demands

Mónica Elizondo-Amaya, PhD Student, Universidad Autónoma de Nuevo León, Graduate Program in Systems Engineering, AP 111-F, Cd. Universitaria., San Nicolas de los Garza, NL, 66450, Mexico, melizondo.amaya@gmail.com, Roger Rios

A stochastic version of a commercial territory design problem in presence of uncertain demands is addressed. A stochastic integer programming model is introduced. The objective is to minimize the territory imbalances with respect to product demand subject to planning criteria such as territory connectivity, compactness, and balance with respect to the number of customers. A metaheuristic for large instances is developed and empirically evaluated.

3 - With Upgrading and Group Booking

Yihua Li, Disney, Orlando, FL, United States of America, Yihua.Li@disney.com, Bruce Wang

Most published Revenue Management models handle Room Upgrading (RU) and Group Bookings (GB) separately from the general Revenue Management problem. This leads to a sub-optimal solution. In this paper, we will build a DLP model together with RU and GB which will make capacities and demands non-independent but crossing room categories. Then we extend our DLP model to a stochastic model (SLP) to counter all uncertainties. Traditional SLP with dynamic programming (DP) is not solvable for most realistic networks because of the large dimensionality of the state space (e.g., typical numbers for even a modest-sized hotel with hundreds of thousands products and for each product DP will go along each of stages = 180-500, each unit of capacities = 500-3000, each of time slots = 500 – 10000, leading to at least 10100 states). Moreover, DP cannot directly deal with RU and GB. We will develop a stochastic model which is solvable together with RU and GB. We accomplish solving it in real time by suggesting a heuristic that generates a good initial feasible solution.

4 - Multi-stage Stochastic Program in Capacity Planning and Technology Acquisition

Lila Rasekh, Disney, Lila.rasekh@gmail.com

Manufacturing flexibility is recognised as one of the key strategies to address uncertain future products demand. Therefore, a growing need exists to investigate the strategic aspect of flexibility. To capture the different aspects of market flexibility in the face of this dynamic demand, this talk focuses on the role of product, volume, and expansion flexibility in the context of the multi-stage stochastic program.

■ MA37

37- North 226 A- CC

Network Design

Sponsor: Location Analysis

Sponsored Session

Chair: Stefan Nickel, Karlsruhe Institute of Technology, Kaiserstrasse 12, Karlsruhe, 76131, Germany, stefan.nickel@kit.edu

1 - Reliable Networks for Smarter Systems

Justo Puerto, Professor, Universidad de Sevilla, Reina Mercedes n.1, 2-A, Sevilla, 41012, Spain, puerto@us.es, Maria Albareda-Sambola, Yolanda Hinojosa

We introduce formulations to location problems where facilities may fail, and service is provided on scene. Service depends of the number of fails encountered by the users. The criterion for the assignments of customers is the distance to the facility previously visited. We compare different exact formulations. Then, we introduce an approximation that works with much lower computing time. Computational experiments show the performance of our formulations.

2 - Integrated Replenishment and Inbound Transportation for High-mix Assembly Lines

Erhan Kutanoglu, The University of Texas at Austin, 204 E Dean Keeton St. C2200, Austin, TX, 78712, United States of America, erhank@mail.utexas.edu, Lesley Chen

Motivated by an actual project, we consider designing an integrated part replenishment and inbound transportation system for a make-to-order assembly plant located away from most of their original contract suppliers. We model the problem with an integer programming formulation and solve it to determine the ordering frequencies and shipping strategies with location-based supplier grouping.

3 - Return-on-investment (ROI) Criteria for the Network Design of Retail Chains

Seokjin Kim, Suffolk University, ISOM Department, 8 Ashburton Place, Boston, MA, 02108, United States of America, kim@suffolk.edu, Rongbing Huang, Mozart Menezes

We develop a model for the optimal location of retail stores operating as an M/M/1/K queue on a discrete network. The objective is to maximize the profit of the chain subject to a minimum required ROI. Our model determines simultaneously the location and number of stores, the allocation of demands to the stores, and investment costs at the stores. We present managerial implications from parametric analysis. We also develop heuristic procedures and computational results are promising.

4 - Multi-period Reverse Logistics Network Design

Stefan Nickel, Karlsruhe Institute of Technology, Kaiserstrasse 12, Karlsruhe, 76131, Germany, stefan.nickel@kit.edu, Sibel Alumur, Francisco Saldanha da Gama, Vedat Verter

The configuration of the reverse logistics network is a complex problem comprising the determination of the optimal sites and capacities of collection centers, inspection centers, remanufacturing facilities, and/or recycling plants. In this talk, we propose a profit maximization modeling framework for reverse logistics network design problems. We present a mixed-integer linear programming formulation that is flexible to incorporate most of the reverse network structures plausible in practice.

■ MA38

38- North 226 B- CC

Variability and Quality of Service Processes I

Sponsor: Service Science

Sponsored Session

Chair: Genady Ya. Grabarnik, St. John's University, Queens, NY, United States of America, grabarng@stjohns.edu

Co-Chair: Arjun Natarajan, IBM TJ Watson Research, United States of America, arjunn@us.ibm.com

1 - Robustness of Sequential Test for Comparative Assessment of Service Process Efficacy

Yefim Haim Michlin, Senior researcher, Technion-Israel Institute of Technology, Faculty of Industrial Engineering & Mana, Haifa, 32000, Israel, yefim@technion.ac.il, Genady Ya. Grabarnik, Ofer Shaham, Laura Shwartz

We construct a binomial SPR test to assess the efficacy of a service team under assumption that the processing time (or TBE) of the customer requests is exponentially distributed. We study the effect of deviation of the TBE from the exponential distribution on the test characteristics. It is shown that for distributions with a coefficient of variation <1, the characteristic of the test is significantly improved.

2 - Informatics for Operational Innovation in Services

Laura Shwartz, Research Manager, T.J. Watson Research Center, IBM, 19 Skyline Dr., Hawthrone, NY, 10532, United States of America, lshwart@us.ibm.com, Genady Ya. Grabarnik

Service providers (SPs) seek innovative changes, which will enable them to successfully compete in the market, expand their service range and further improve the delivery of IT services. Operational Innovation (OI) has become a vital necessity for SPs. It affects what SP employees do every day and how they do that. Because it impacts the very core of delivery, there is an obvious risk associated with it. In addition variability and volatility of IT Services make it difficult to predict the value of improvement when deployed in production environment. We will have focused discussion on what are the skills, knowledge and approach, which should be defined and prescribed for study to students aiming to apply their intellect to discovering, developing, and validating new principles, theory, and methods which improve operations and management of enterprises.

3 - A Method to Systematically Articulate the Value of IT Outsourcing Services to Clients

Rama Akkiraju, Distinguished Engineer, Service Solution Design, IBM Research, 650 Harry Road, Almaden Research Center, San Jose, CA, 95120, United States of America, akkiraju@us.ibm.com

IT outsourcing service providers are exploring various ways to offer innovative, high quality and differentiated services to their clients to increase their profit margins in an increasingly commoditizing market. However, they struggle to articulate the value of these services to the client to win the bid. We present a systematic method-based approach to enable IT outsourcing service providers to articulate the value of their services to the client to increase their changes of winning a bid.

4 - Driving a Quality Transformation in IT Services

Arjun Natarajan, IBM TJ Watson Research, United States of America, arjunn@us.ibm.com

Quality of IT Services has become increasingly complex for both service providers and consumers. Large-scale outsourcing, global fulfillment and delivery, fragmented providers, lack of comprehensive metrics and a highly mobile workforce are some of the factors driving the complexity and challenges to providing predictable, high quality IT services. We will discuss a conceptual framework on how to intuitively think about services quality and operational actions to drive a quality transformation.

■ MA39

39- North 226 C- CC

Advances in Service Industry Models

Contributed Session

Chair: Ray Strong, Research Staff Member, IBM, 650 Harry Road, San Jose, CA, 95120, United States of America, hrstrong@us.ibm.com

1 - Design and Analysis of Contracts for Service Outsourcing under Asymmetric Information

Zongming Zhang, PhD, Xi'an Jiaotong University, Xi'an, Shaanxi, P.R. China, Xi'an, 710049, China, zhang.zongming@stu.xjtu.edu.cn, Shulin Liu, Xiuwu Liao

We analyze contracting issues and information value arising in IT service outsourcing. Depending on whether the service provider's effort information and cost information are symmetric or not, we investigate how service outsourcing contracts can be designed in four scenarios. And the value of effort information and cost information is discussed.

2 - A Robust Risk Management Framework in the Services Supply Chain: A Just in Time Perspective

Andrew Johnson, PhD Student, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, andrew.johnson@rutgers.edu, Steven Carnovale, Sengun Yeniyurt

Literature on risk in supply chain management speaks predominantly about traditional supply chains and doesn't explicitly speak about risk in service supply chains. We wish to contribute to the development of a framework for risk management in service supply chains. Theoretically driven propositions are explored through the just-in-time management philosophy.

3 - Enhancing Service Loyalty: New Insights on Nonlinear Effects of Customer Delight and Satisfaction

Dennis Ahrholdt, Institute for Operations Research-University of Hamburg, Von-Melle-Park 5, Hamburg, Germany, Dennis.Ahrholdt@uni-hamburg.de, Christian Ringle, Siegfried Gudergan

This study substantiates the important roles of customer satisfaction and delight in simultaneously influencing customer loyalty in service settings. Particularly, it sheds light on the functional form of satisfaction's and delight's effect on loyalty and, subsequently, on the effect of service experience as a moderator. Drawing on partial-least-squares structural equation modeling and using two large customer-data samples relevant insights into the management of customer loyalty are provided.

4 - Service Network Mining Method

LiYing Cui, Kimberly-Clark, 1400 Holcomb Bridge Road, Roswell, GA, United States of America, Liying.cui@kcc.com

Services can be provided by several media including people, software and consumer goods all falling under the general umbrella of "service providers." Service composition is to form a compound workflow of services so that this compound workflow can execute complex tasks which cannot be done by an individual service. This research deals with the network prospective of service composition, or service network mining.

5 - Estimating and Predicting Service Delivery Costs

Ray Strong, Research Staff Member, IBM, 650 Harry Road, San Jose, CA, 95120, United States of America, hrstrong@us.ibm.com, Mario Lichtsinn, Anca Chandra, Neil Boyette, Sechan Oh

Negotiating service contracts includes estimating the cost of providing agreed services. Service delivery accounting allocates actual costs to contracts. Pricing of contracts could be improved by predicting the profitability of specific contracts while they are ongoing. We report the results of an experiment in relating the original cost estimate for a service contract with the actual costs allocated to that contract and predicting future behavior of the contract and its parts.

■ MA40

40- North 227 A- CC

Water Resources Management

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Guzin Bayraksan, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, guzinb@sie.arizona.edu

1 - An RLT-based Branch-and-Reduce Approach to the Regional Water Supply System Design Problem

Fujun Lan, University of Arizona, 1127 E. James E. Rogers Way, Room 111, P.O. Box 210020, Tucson, AZ, 85721, United States of America, flan@email.arizona.edu, Guzin Bayraksan

We present a multistage model to design a regional water supply system and develop an algorithm to solve the resulting nonconvex problem. The lower bounding problem is constructed by successively transforming the space of certain design variables, polyhedral outer approximations, and Reformulation Linearization Technique (RLT). Feasibility and optimality-based range reduction techniques are employed to speed up convergence. We discuss convergence and present computational results.

2 - Efficient Distribution of Water between Head-reach and Tail-end Farms in Developing Countries

Mili Mehrotra, University of Minnesota, 321 19th Ave., South, Minneapolis, MN, United States of America, milim@umn.edu, Milind Dawande, Srinagesh Gavirneni, Vijay Mookerjee

In developing countries, inequity in surface water distribution to farms arises due to their relative physical locations: water for tail-end farms must pass via their head-reach counterparts. We propose two decentralized coordination schemes: rate-card and water-guarantee for efficient distribution.

3 - A Data-driven Method for Robust Water Allocation under Uncertainty

David Love, University of Arizona, Tucson, AZ, United States of America, dlove@math.arizona.edu, Guzin Bayraksan

The Colorado River Basin, which supplies water to over 25 million people in the southwestern US, has experienced a sustained period of drought in recent years, raising questions about its ability to meet future demands. We adapt the Likelihood Robust Optimization method recently proposed by wang,Glynn and Ye to examine water allocation under the ambiguous distribution of future rainfall. We examine the properties of the model, relate it to risk models, and present computational results.

4 - A Smoothing Algorithm to Solve a Complex Model for Regional Biofuel Development

Mashor Housh, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, mashor.housh@gmail.com

A MILP model that combines refinery, transportation, agriculture, water resources, crops and energy markets is developed to address biofuel production, infrastructure needs, and policy implications. The model is solved by a specially designed smoothing algorithm based on a heuristic method which converts the MILP to a sequence of problems each involving a minimization of a continuously differentiable function. Comparison between the smoothing algorithm and a commercial MILP solver is provided.

■ MA41

41- North 227 B- CC

Markets and Demand for Energy

Contributed Session

Chair: Ali Tajer, Research Scholar, Princeton University, B311 E-Quad, Princeton, NJ, 08544, United States of America, tajer@princeton.edu

1 - Spatial Analysis for Hydrogen Consumer Demand

Muhammad Dayhim, Rutgers University, 100 Brett Road, Piscataway, NJ, 08854-8018, United States of America, dayhim@eden.rutgers.edu, Mohsen Jafari, David Hill

There are several factors and key attributes which have influence on consumer choice to buy Fuel cells. At the same time, consumer preference on the demand side is the most important factor in predicting changes in the market. This study developed a spatially aggregated demand model which can estimate the potential demand for those who are interested in purchasing Fuel Cell and eventually consume hydrogen based on different household attributes and present geographically on the map.

2 - LFMM – A New Refinery Model in NEM

Michael Cole, OR Analyst, Energy Information Administration, 1000 Independence Ave., SW, Washington, DC, United States of America, michael.cole@eia.gov

The Liquid Fuels Market Model (LFMM) is an LP representation of the US liquid fuels market, including both petroleum fuels and biofuels. As part of the National Energy Model (NEM), it is used by EIA to produce projections of the U.S. energy economy out to 2040. LFMM is implemented in GAMS within the NEM Fortran framework. The presentation will provide a summary of the features of the LFMM model and details on its implementation.

3 - Distributed Demand Prediction in Energy Grids

Ali Tajer, Research Scholar, Princeton University, B311 E-Quad, Princeton, NJ, 08544, United States of America, tajer@princeton.edu

The paper offers a theoretical framework for distributed prediction of the state of energy grids. This prediction methodology takes into account the uncertainties pertinent to the underlying physical and sensing models and is adaptive to the rapidly evolving structural dynamics and control techniques. This methodology involves adaptive dynamic reconfiguration of the grid model based on closed-loop learning and effectively weighing and combining the sensed data from different sensing sources.

4 - Competition between Heavy and Light Users

Steven Shugan, Professor, University of Florida, 2030 NW 24th Avenue, Gainesville, FL, 32605, United States of America, sms@ufl.edu

Firms with limited capacity sometimes force consumers to compete for capacity based on usage rates. Firms can design usage games with rationing mechanisms that favor either light or heavy users. Surprisingly, optimal rationing mechanisms often favor heavy users even though conventional economic wisdom suggests discriminating against heavy users who have the highest valuation for the service. The key is distinguishing between users who are making Quantal vs. Quantity decision.

■ MA42

42- North 227 C- CC

Transportation Infrastructure Management

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Pablo Durango-Cohen, Associate Professor, Northwestern University, 2145 Sheridan Road, A332, Evanston, IL, 60208, United States of America, pdc@northwestern.edu

1 - A Multivariate Statistical Framework for Monitoring the Performance of Transportation Infrastructure

Yikai Chen, PhD Candidate, Northwestern University, 2145 Sheridan Road, A320, Evanston, IL, 60208, United States of America, yikai.chen@u.northwestern.edu, Pablo Durango-Cohen

We present a statistical framework for the analysis of realtime performance data of transportation infrastructure. It applies statistical process control tools to simultaneously monitor multiple interrelated facilities and alarm changes in their structural conditions to support decisions in resource allocation. We provide results of implementing the framework on the Hurley Bridge in Wisconsin.

2 - Incorporating Network Considerations into System-level Maintenance Decision-making for Pavements

Aditya Medury, PhD Candidate, University of California, Berkeley, 1910 Berryman St., Apt 101, Berkeley, CA, 94709, United States of America, amedury@berkeley.edu, Samer Madanat

The state-of-the-art Markov decision process-based approaches in infrastructure management, while optimal for solving budget allocation problems, become sub-optimal upon introducing network constraints. An approximate dynamic programming (ADP) framework is proposed, wherein capacity losses due to construction activities are subjected to a network capacity threshold. A parametric study is conducted on a stylized network to infer the impact of network constraints on the decision-making process.

3 - An Application of Clusterwise Regression to Model Heterogeneity of Pavement Panel Data

Weizeng Zhang, PhD Candidate, Northwestern University, 2145 Sheridan Road, A316, Evanston, IL, 60208, United States of America, WeizengZhang2009@u.northwestern.edu

A post hoc clustering model is presented to predict pavement performance and partition pavement sections into segments where sections have the greatest similarity in terms of the performance deterioration process. Different from Random Effects, Fixed Effects and Random Coefficients models, the proposed clustering model captures the heterogeneity on the segment level. The clustering results can aid R&M decision making for each segment. A numerical comparison is provided based on AASHO dataset.

4 - System-Level Bridge Management Policies with Feedback Control

Haotian Liu, PhD Candidate, University of California, Berkeley, 116 McLaughlin Hall, Berkeley, CA, 94720, United States of America, liuht05@berkeley.edu, Samer Madanat

In bridge management, empirically estimated models sometimes yield poor prediction due to data availability and quality, and conqsequently incur significant costs in policy decision-making. This research presents an Open-Loop Feedback Control approach which successively updates deterioration models as new data becomes available. We expect cost savings as opposed to Open-Loop optimization. Data is sourced from FHWA's NBI database.

■ MA43

43- North 228 A- CC

Impact of Positive Train Control on Railways

Sponsor: Railway Applications

Sponsored Session

Chair: Carl VanDyke, Partner, Oliver Wyman, One University Square, Suite 101, Princeton, NJ, 08540, United States of America, Carl.VanDyke@oliverwyman.com

1 - PTC Overview, Risk Factors, and Research Needs

Carl VanDyke, Partner, Oliver Wyman, One University Square, Suite 101, Princeton, NJ, 08540, United States of America, Carl.VanDyke@oliverwyman.com

An overview of PTC will be presented, including the base technological strategy. The different approaches to implementing PTC will be presented, and the reasons for why the "overlay" approach has been adopted for the U.S. will be explored. A number of key risk factors and research needs will also be explored.

2 - Capacity Implications of PTC Now and in the Future

David Thurston, Vice President, Systems Engineering, Parsons Transportation Group, 1601 Market St., 9th Floor, Philadelphia, PA, 19103, United States of America, david.thurston@parsons.com

How PTC will be applied for the various types systems that are being built (I-ETME. ACSES and ITCS) and how each design impacts capacity will be discussed. The future evolution of these systems and their future impacts on capacity will also be examined.

3 - Development of Postive Train Control at CSX Transportation

Suneil Kuthiala, CSX Transportation, 500 Water Street, Jacksonville, FL, 32202, United States of America, suneil_kuthiala@csx.com

All railroads have been manadated to install PTC by 2015 by an Federal law. To achieve this aggressive timetable, significant amounts of planning, research, network analysis, systems design, testing, and capital planning must be undertaken. This presentation will explore the actions CSX is taking to identify which lines will require PTC and get in installed prior to the deadline.

4 - Potential Synergies from Positive Train Control

Bruce Patty, Vice President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, bpatty@veritecsolutions.com

Given the communications platform and train status data available from PTC, many suggestions for how to leverage this information to improve management of the railway have been made. A number of these concepts will be presented and their feasibility and benefits explored.

■ MA44

44- North 228 B- CC

Operations in Supply Chain

Contributed Session

Chair: Sangdo Choi, Texas A&M University, 3131 TAMU, College Station, TX, United States of America, samsd.choi@gmail.com

1 - Operations Scheduling with Sequencing Restrictions and Delivery Deadlines

Gang Wang, Rutgers Business School, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, gangwang@pegasus.rutgers.edu, Lei Lei

We study the problem of scheduling a two-echelon supply chain network with sequencing restrictions and delivery deadlines. The problem is to find an operations schedule so that the network capacity constraints are satisfied while the penalty and shipping costs are minimized. In this paper, we presented a special case solved in polynomial time. To solve the general problem, we proposed a heuristics algorithm and conducted computational experiment to verify the effectiveness of the algorithm.

2 - Bullwhip and Re-planning Intervals: Impact on the Shop Production Orders in a Supply Chain

Ahmet Ozkul, Assistant Professor of Management, University of New Haven, 300 Boston Post Rd, West Haven, CT, 06516, United States of America, aozkul@newhaven.edu

The purpose of this study is to investigate the impact of buyer's re-planning frequency on supplier's production orders amplification in a supply chain. In a simulated two firm supply chain, an assembler creates production plans and updates them in every RA periods. A supplier satisfies the assembler's orders with rate production, adjusted in every RS periods. Impact of different pairs of RA and RS on the variance of the supplier's shop production orders is our research focus in this project.

3 - Manufacturer's Safety Stock Requirements to Support Distributors' Multi-product Orders

Kai-Chuan Yang, University of California, Berkeley, IEOR Department, Berkeley, CA, 94720, United States of America, kcyang@gmail.com, Candace Yano

We consider a manufacturer that produces many products using a stable schedule due to changeover times and tight capacity, and seeks to satisfy orders from distributors who order unpredictably. We present an analytical model to estimate safety stock needs under both a policy that mimics distributors' current ordering behavior of and a new ordering policy that enables the manufacturer to achieve better service with lower inventory levels. The new policy reduces safety stock needs significantly.

4 - A Time-based Newsvendor Approach to Synchronous Production and Delivery Schedule

Sangdo Choi, Texas A & M University, 3131 TAMU, College Station, TX, United States of America, samsd.choi@gmail.com

We provide a time-based newsvendor approach to synchronous production and delivery schedule under Just-in-Time environment. The time-based newsvendor approach assumes that demand quantity is fixed and that time interval is decision variable, whereas the traditional newsvendor approach assumes that demand is uncertain and that time interval is fixed. We show that the optimal sequence is smallest variance first rule when all production times are independent and normally distributed.

5 - Dynamic Supplier Selection Optimization for Supply Chain Sourcing

Jing Huang, Ohio University, 285 Stocker Center, Athens, OH, United States of America, jane.huang.yo@gmail.com, Gursel Süer

We propose a long-term sourcing framework to capture supplier dynamics with objectives such as minimizing cost, improving quality and service level. In this framework, an optimization model makes the purchasing decisions for each period via fuzzy multi-objective programming, and a simulation model continuously updates supplier's performances according to historical purchasing decisions. The experimentation results shows the adaptability of proposed approach in the dynamic market environment.

■ MA45

45- North 229 A- CC

Stochastic Baseball Analysis

Sponsor: SpORts

Sponsored Session

Chair: Katsunori Ano, Professor, Department of Mathematical Sciences, Shibaura Institute of Technology, 307 Fukasaku, Minuma-ku, Saitama, 337-8570, Japan, k-ano@shibaura-it.ac.jp

1 - Win Probability of Baseball Game in NPB

Norio Torigoe, Associate Professor, Tokai Univeristy, 4-1-1 Kitakaname, Hiratsuka, Kanagawa, 2591292, Japan, torigoe@tokai-u.jp

We present an algorithm for calculating the Win Probability of baseball game, which is held in Japanese professional baseball league (NPB). Moreover, we consider how much does the new ball that was adopted by NPB from 2011 season have an effect on a fluctuation of Win Probability. This study is supported by Data Stadium Inc.

2 - Probability Calculation for Tournament Format of World Baseball Classic

Nobuyoshi Hirotsu, Associate Professor, Juntendo University, 1-1 Hiragagakuendai, Inzai, 270-1695, Japan, n_hirotsu@sakura.juntendo.ac.jp, Suzaki Masabumi

The first World Baseball Classic (WBC) in 2006 employed a round-robin format in the round 1 and 2. Because of complicated tiebreaking procedures, the second WBC in 2009 introduced a double-elimination format. In this format, however, some teams played each other too many times such that Japan and Korea played 5 times. Here, the probability of the number of times a team plays every other team is calculated, and an effect of the modification of this format for the third WBC in 2013 is discussed.

3 - How to Choose Free Agent Batters?

Katsunori Ano, Professor, Department of Mathematical Sciences, Shibaura Institute of Technology, 307 Fukasaku, Minuma-ku, Saitama, 337-8570, Japan, k-ano@shibaura-it.ac.jp

We consider a stochastic model to choose free agent batters. It maximizes the expected earned run obtained by the optimal batting order with him, which based on Markov chain formulation of Baseball, and also minimizes a risk of the batter. This stochastic portfolio analysis suggests the decision for which batter is best. The model can impose manager's subjective perspective of the free agent batter.

■ MA46

46- North 229 B- CC

Joint Session ORG/TMS: Exploring the Process of Emergent Innovation: Knowledge Creation and Invention in Complex Adaptive Systems

Sponsor: Organization Science & Technology Management

Sponsored Session

Chair: James Hazy, Associate Professor, Adelphi University, 1 South Avenue, Garden City, NY, United States of America, hazy@adelphi.edu

1 - Processes for Incremental vs. Radical Innovation

Tomas Backström, Professor, Malardalen University, P.O. Box 325, Eskilstuna, 63105, Sweden, tomas.backstrom@mdh.se

Are there qualitative differences in the processes behind incremental and radical innovation? Incremental innovation is described as a process of emergence leading to continuously improving fitness of the system. Radical innovation is described as a punctuated development, where innovation maturity increases during the quiet times, to be used for jumps of fitness improvements when needed. But the increase of innovation maturity is a process of emergence.

2 - Space for Emergent Innovation

Erik Lindhult, Malardalen University, Eskilstuna, 63105, Sweden, erik.lindhult@mdh.se

The paper will explore the meaning and role of space – chronological, economic, social, cultural – for the emergence of innovation in services, processes and products, based on research from different organizational settings. This calls for "space management" as an important innovation leadership task from a complexity perspective.

3 - Emergent Innovation as a Ratcheting Process that Accumulates Positive Deviations

James Hazy, Associate Professor, Adelphi University, 1 South Avenue, Garden City, NY, United States of America, hazy@adelphi.edu, Tom Shinick

Inventions can be observed as assignable deviations from the norm with positive though unrealized potential. Innovation recognizes, captures, and preserves inventions in a ratcheting process. By accumulating inventions, it evolves what is seen as normal activity in a positive direction with regards fitness. At each click of the ratchet, new information about what works is embedded in the system, events becomes more predictable, and additional recombination potentialities are created.

■ MA47

47- North 230- CC

Modeling Travel Behaviors Using Emerging Data Sources

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Yingyan Lou, Assistant Professor, The University of Alabama, 260 H.M. Comer, Tuscaloosa, AL, 35487, United States of America, ylou@eng.ua.edu

1 - Inferring Individual Activity Patterns using Large-scale Geo-location Data

Samiul Hasan, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, samiul@purdue.edu, Satish Ukkusuri

The recent introduction of the location-based services in various smartphone applications has enabled people to share their activity related choices at the level of specific geo-referenced location and time. Multi-day patterns of individual activity behaviors can be inferred from this large-scale geo-location information. In this work we first develop a model for inferring the semantic labels of activity locations. This model helps to identify an individual's home and workplace from the check-in patterns. We then develop a hierarchical Bayes model for predicting patterns in individual activity choice behaviors

2 - Modeling Location Choices for Discretionary Activities using Large-scale Data Collected from Online Social Media
Samiul Hasan, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, samiul@purdue.edu, Satish Ukkusuri

A significant amount of traffic is generated due to the non-work related discretionary activities such as eating out, shopping, recreational, social visits, and so forth. Realistic behavioral models of individual location choices for these secondary activities have great importance in activity-based travel demand analysis. However, large-scale empirical observations for secondary activity location choices are not very common. In this work we develop a location choice model for discretionary activities using a large collection of check-in information shared in online social media.

3 - Discovering Daily Driving Patterns during Disaster Recovery using Mobile Sensors
Jeff Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St., JEC 4034, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu, Yingyan Lou, Cara Wang

Although evacuation and emergency management immediately after disasters have been extensively studied (e.g., the field of humanitarian logistics), relatively little attention has been put on what usually happened during disaster recovery. This is however vital to understand the factors that facilitate or hinder the extended recovery process after major disasters. Mobile sensors provide novel opportunities to reveal the behaviors (expected to be dynamic and varying over time) of both individual travelers and the traffic system during such processes, for which data collection has been a long standing challenging issue. We present our recent work and some preliminary results of using mobile sensors to track the daily (driving) patterns of individuals who impacted by major disasters. The results clearly show the close correlation between daily travel patterns and recovery activities of the individuals (e.g., to rebuilding the old house that was destroyed by the disaster).

4 - Understanding Psychological Effects of Real-time Travel Information on the Travel Experience
Dongyoon Song, NEXTRANS Center, USDOT Region V Regional UTC, School of Civil Engineering, Purdue University, West Lafayette, IN, 47906, United States of America, song50@purdue.edu, Srinivas Peeta

Real-time travel information has been disseminated to travelers in many ways to improve the efficiency of the network and enhance the travel experience. We propose a framework to elicit the psychological mechanisms associated with real-time information. Three types of information-related stresses are identified and analyzed using a structural equation model (SEM) with latent variables.

3 - Use of Telemetry in Stochastic Routing
Amit Verma, University of Iowa, W244 John Pappajohn Bus Bldg, Iowa City, IA, United States of America, amit-verma@uiowa.edu, Ann M. Campbell

Telemetry units can be used to gauge inventory levels at customers. Having these readings can help prevent stockouts and unnecessary deliveries. We present a model for the problem of where to place a limited number of telemetry units to minimize routing costs. We model the customers without telemetry as having a predetermined delivery frequency but allow the delivery dates for telemetry customers to vary according to realizations of usage. We will present a heuristic and computational results.

4 - Stochastic Modeling of Postponement Strategies in Uncertain Environments
Stefan Voss, Universitat Hamburg Institut für Wirtschaftsinformatik, Von-Melle-Park 5, Hamburg, D-20146, Germany, stefan.voss@uni-hamburg.de, Frank Schwartz, Achim Koberstein

Global production and distribution systems require procrastinating certain manufacturing steps of a product towards the end of a supply chain. Following this postponement concept, a product is not necessarily finished at the production site. Instead different manufacturing steps may be executed while the product is shipped to the customer. In this paper, we extend excisting quantitative models allowing for decision making for specific postponement implementations in uncertain environments. We provide state-of-the-art implementations of specialized solution algorithms to solve related stochastic programming models. Namely, we apply a parallelized implementation of the L-Shaped method for two-stage and multi-stage stochastic programming models with mixed-binary first stage. As a result of our new settings we successfully show that the earlier models may be extended in a meaningful way and getting solutions based on standard solvers is possible even in more realistic settings than done before.

5 - Bidding Advisory Model for Combinatorial Auctions in Freight Transportation Incorporating LTL Schemes using Branch-and-Price
Rodrigo Mesa-Arango, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, rmesaa@gmail.com, Satish Ukkusuri

In this paper we present a bidding technique that can be used by a Less-Than-Truckload (LTL) company in order to submit optimal quotes in a combinatorial auction. The objective is to minimize the miles traveled by trucks. This problem is solved using a Branch-and-Price technique. Numerical results show the implications of using LTL strategies over the usual Truck-Load (TL) strategies presented in previous literature.

■ MA48

48- North 231 A- CC

Freight Planning and Routing

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Ann M. Campbell, University of Iowa, W244 John Pappajohn Bus Bldg, Iowa City, IA, 52242, United States of America, ann-campbell@uiowa.edu

1 - Optimization Based Adaptive Large Neighborhood Search (ALNS) for the Production Routing Problem
R Jans, HEC Montreal, 3000 Chemin de la Cote Ste-Catherine, Gol Bureau 5.821, Montreal, QC, H3T 2A7, Canada, raf.jans@hec.ca, Yossiri Adulyasak, Jean-FranÁois Cordeau

The production-routing problem integrates a multi-level dynamic lot-sizing problem with vehicle routing decisions. We present a heuristic which combines an ALNS on the binary variables with a network optimization approach for the continuous variables. The computational results show that this algorithm is superior to existing approaches on benchmark test instances.

2 - Exact Algorithms for Multi-vehicle Production and Inventory Routing Problems
Yossiri Adulyasak, HEC Montreal, 3000 Chemin de la Côte Ste-Catherine, Montreal, QC, Canada, yossiri.adulyasak@hec.ca, R Jans, Jean-François Cordeau

The production routing problem and the inventory routing problem combine production/inventory decisions with vehicle routing decisions over many periods. Our research focuses on the multi-vehicle aspect which is often ignored in the literature. Two formulation schemes and a branch-and-cut algorithm are introduced and extensive computational results are provided.

■ MA49

49- North 231 B- CC

Transportation Infrastructure Management I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu

1 - Optimization of Freight Unloading & Reloading Operation with Time-window at Rail Intermodal Terminal
Feng Wang, Researcher, Jackson State University, 1230 Raymond Rd, #900, Jackson, MS, 39204, United States of America, feng.wang@jsums.edu, Lei Bu, Haitao Gong, Chuanzhong Yin

An integer programming model is developed to optimize the transloading process of freight unloading from ship containers and reloading to railroad containers at rail intermodal terminal. The model introduces unloading and reloading time-window as an important constraint to be established by an integer programming method in an attempt to minimize the railroad container transport cost, while reducing container usage for the railroads by improving payload or cubic capacity utilization rate.

2 - Scenario-based Approach to Reliability Modeling using Traffic Simulation Tools
Jiwon Kim, Northwestern University, Evanston, IL, United States of America, JiwonKim2012@u.northwestern.edu, Hani S. Mahmassani

Conceptual and methodological aspects of a scenario-based approach for predicting reliability levels in evaluating transportation alternatives are presented. The methodology is applied in connection with a simulation-based DTA tool, specifically the impact of incidents and weather on the variation of travel times.

3 - Managing Pavement Maintenance and Rehabilitation Projects: A Stochastic Optimization Approach

Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu

A good pavement management system (PMS) can enable decision makers to select the best maintenance/rehabilitation program, i.e., which maintenance treatment to use and where and when to apply it, so that a maximum utilization of available resources can be achieved. An stochastic optimization based integer linear programming model is formulated and solved. Case study is performed and comprehensive numerical results are also presented.

4 - The Work-zone Scheduling Problem in Urban Networks

Hong Zheng, Research Assistant Professor, University of Arizona, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, hzheng@email.arizona.edu, Yi-Chang Chiu, Eric Nava

In this talk we present a bi-level multi-year work zone scheduling problem and solution algorithm. The objective of the model is to minimize traffic delay considering network-wide traffic diversion. The traffic diversion is assessed via an approximated traffic assignment algorithm embedding a k-shortest path algorithm in order to speed up computational time. A numerical example is presented to illustrate the property of the proposed algorithm.

■ MA50

50- North 231 C- CC

Military Vehicle Routing I

Sponsor: Military Applications

Sponsored Session

Chair: Michael Hirsch, Raytheon Company, Orlando, FL, United States of America, mjh8787@ufl.edu

1 - Optimal Trajectories for Unmanned Surface Vehicles in Direction-dependent Wavefield

Alvaro Maggiar, PhD Candidate, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, alvaro.maggiar@u.northwestern.edu, Irina Dolinskaya

Unmanned systems have become increasingly important in a wide range of applications. Autonomous surface vehicles are replacing sea vessels as a safer and more efficient option for a number of missions. A key component to their effectiveness is on-board real-time path planning algorithms that integrate the complex vessel dynamics and effects of surrounding waves. We present the analysis and numerical results for the optimal vessel trajectories in these direction-dependent environments.

2 - Re-acquisition of Lost Mobile Targets using a Small Unmanned Aerial Vehicle

Daniel Pack, US Air Force Academy, USAFA, CO, 80840, United States of America, Daniel.Pack@usafa.edu, Hyukseong Kwon

Tracking a mobile ground target using a small UAV with a camera sensor is a challenging task due to the limited sensor field of view (FOV). The focus of the current work is to exploit the interplay between sensing and control of a small UAV to maximize the likelihood of keeping mobile targets within the sensor FOV and re-capturing them, if the targets are lost. We show an optimization method by incorporating UAV dynamics, estimates of mobile target states, and the camera sensor models.

3 - A Risk-averse Differential Game Approach to Multiagent Routing and Formation with Stochastic Targets

Khanh Pham, Air Force Research Laboratory, Space Vehicles Directorate, 3550 Aberdeen Ave., S.E., Kirtland Air Force Base, NM, 87117, United States of America, Khanh.Pham@kirtland.af.mil

This talk considers a class of distributed stochastic multiagent systems where local interconnections among self-directed agents are determined by the use of graph theory. Associated with self-directed agents are finite-horizon performance measures for conflict-free routing and cohesive target tracking. It is shown that risk-averse agents effectively employ decentralized compensators driven by local noisy observations and timely implement output-feedback Nash policies for distributed decisions.

■ MA51

51- North 232 A- CC

Social Network Analysis in National Security

Sponsor: Military Applications

Sponsored Session

Chair: Richard F. Deckro, Professor of Operations Research, Air Force Institute of Technology, AFIT/ENS; Bldg 641, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, richard.deckro@afit.edu

1 - DOE for Assessing Social Network Analysis Techniques

James Morris, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, james.morris@wpafb.af.mil, Richard F. Deckro, Darryl Ahner, Jonathan Hamill, Dursun Bulutoglu

Social Network Analysis' techniques can be investigated through Design of Experiments (DOE). Analysis of network models using DOE is sometimes accomplished through traditional ordinary least squares regression, which may result in non-normality of residuals of fitted models. A full factorial design augmented with a nearly orthogonal Latin hypercube of a SNA technique is examined via a linear model constructed using quantile regression to mitigate the non-normality of the error terms.

2 - Quantitative Intelligence Analysis

Christopher Smith, PhD Student, U.S. Army/ University of Virginia, 1044 Autumn Hill Ct, Crozet, VA, 22932, United States of America, christopher.m.smith@us.army.mil, William Scherer, Stephen Carr

A methodology is proposed to supplement the subjective "value" of intelligence with an objective metric of "impact" of intelligence on network models. This metric would measure the impact of a piece of intelligence on a network's metric, being used to answer analyst intelligence questions or gain insight on a network. Our methodology suggests that on an intelligence driven network, each document can bring information in the form of unique links and nodes which can be measured quantitatively.

3 - Quantifying Uncertainty Associated with Reliability Analysis in Multi-state Social Networks

Kellie Schneider, Instructor of Freshman Engineering, University of Arkansas, 324 Engineering Hall, Fayetteville, AR, 72701, United States of America, Kellie@uark.edu, Chase Rainwater, Ed Pohl

We address the uncertainty associated with a reliability analysis of an influence campaign directed at a clandestine organization. We model influence as a multi-state commodity and quantify the uncertainty in both influence level probabilities and the structure of the network. Optimization tools are proposed to identify significant players in the network and inform the allocation of influence to improve (degrade) the performance of the system.

4 - A New Objective Function for Network Clustering

Marcus Perry, The University of Alabama, Tuscaloosa, AL, United States of America, mperry@cba.ua.edu

In this talk we propose a new objective function for network clustering that naturally lends to a statistical test on the significance of the detected clusters. The proposed objective function also permits the use of information criterion for determining the appropriate number of clusters. Using Monte Carlo simulation, we make performance comparisons between the proposed objective function and those obtained by maximizing modularity.

■ MA52

52- North 232 B- CC

Research Needs of the Electricity Industry

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

1 - Challenges to Market Participants

Alva Svoboda, Manager, Pacific Gas and Electric Co., 77 Beale St., Rm. 2565F, San Francisco, CA, 94105, United States of America, ajsh@pge.com

The combination of continuing improvements in optimization technologies, developments in stochastic optimization methods, and ISO responses to renewables integration pose interesting O.R. challenges to market participants in the valuation of new resources, contracting, and day-to-day bidding and dispatch functions.

2 - Research Needs of the Electricity Industry
Richard O'Neill, Chief Economic Advisor, FERC, 888 First St NE, Washington, DC, 20426, United States of America, richard.oneill@ferc.gov

We have 20 years of experience with competition and open access. New technologies including solar, wind, batteries, and price-responsive demand continue to penetrate the market. The ISO market design needs to reflect the impact the new technologies. Improvements in IT include better measurement, communications and algorithms. Pricing needs to be better aligned with cost causation. We will discuss the research needed to improve market efficiency.

3 - Computational Needs for Bulk Power System Operation and Planning
Tongxin Zheng, Technical Manager, ISO New England, 1 Sullivan Road, Holyoke, MA, 01106, United States of America, tzheng@iso-ne.com, Eugene Litvinov

Reliability and Economics are two major aspects of power system operation and planning. With the introduction of market mechanism, they are being tightly integrated in many processes in operations and planning, creating challenging mathematical problems in both operations research and micro economics. The paper identifies the critical problems in these areas, and summarizes existing solution methodologies as well as future computational needs under the ISO managed market environment.

■ MA53

53- North 232 C- CC

New Models and Algorithms for Power Grid Transmission

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Qipeng Zheng, Assistant Professor, West Virginia University, Industrial & Management Systems Engineer, P. O. Box 6070, Morgantown, WV, 26505, United States of America, qipeng.zheng@gmail.com

1 - Transmission Switching in Power System Operations
Jianhui Wang, Argonne National Laboratory, Argonne National Laboratory, Lemont, IL, 60439, United States of America, jianhui.wang@anl.gov, Cong Liu, James Ostrowski

Studies have shown that transmission switching can lead to more operational cost savings. However, modeling challenges remain due to the additional variables and constraints associated with transmission switching. In this talk, I will discuss several modeling aspects related to transmission switching including prescreening, symmetry breaking and static security issues. Some numerical examples are given to illustrate the effectiveness of the proposed methods.

2 - An Exact Algorithm for Power Grid Interdiction Problem with Line Switching
Long Zhao, University of South Florida, 14249 Les Palms Circle, Tampa, FL, 33613, United States of America, longzhao@mail.usf.edu, Bo Zeng

As one of the most effective operations to mitigate deliberate outages or attacks, transmission line switching recently has been included in power grid interdiction model. This bi-level problem is a challenging nonconvex discrete optimization problem, and only a few recent heuristic procedures are available. In this talk, we describe a column-and-constraint generation algorithm to derive the global optimal solution. Numerical results confirm the quality of solutions.

3 - Optimization and Risk Analysis of Distributed Energy Systems
Shaya Sheikh, Case Western Reserve University, 12000 Fairhill Rd. Apt 406, Cleveland, OH, 44120, United States of America, sxs697@case.edu, Behnam Malakooti

Integrated Energy problems representing variety of commonly used energy systems are presented. The presented models are flexible to changes in demand, energy price, and risk attitude of energy providers. A robust and simple approach is used for understanding and measuring risk of energy providers. Computational results show that problems with thousands of entities can be solved efficiently within reasonable time.

■ MA54

54- Regency Ballroom A- Hyatt

Networks

Sponsor: Telecommunications

Sponsored Session

Chair: Ivan Guardiola, Assistant Professor, Missouri University of Science and Technology, 600 W. 14th Street, Rolla, MO, 65409, United States of America, guardiolai@mst.edu

1 - Solution Approaches for Access Network Design Problem with Hierarchical Nonlinear QoS Constraints
Youngho Lee, Korea University, Anamdong 5 Ga, Sungbuk Gu, Seoul, Korea, Republic of, yhlee@korea.ac.kr

We present an access network design problem with hierarchical nonlinear QoS constraints. The problem seeks to minimize the total cost of fiber link and switches, while satisfying both the capacity of switches and the prescribed level of quality of service. We linearize the nonlinear QoS constraints by incorporating mixed-integer linear constraints with auxiliary variables. Then we devise inner and outer approximation algorithms for finding an optimal solution.

2 - Using Cross Entropy Methods to Determine Reliable Link Routes in MANETs
Ivan Guardiola, Assistant Professor, Missouri University of Science and Technology, 600 W. 14th Street, Rolla, MO, 65409, United States of America, guardiolai@mst.edu, Brian Schaefer, Shikhar Acharya

This presentation highlights the use of the Cross Entropy Method to determine the most reliable link routes within a Rayleigh Fading envelop. We use the cross entropy method as a mean to simulate and optimize received signal power in order to determine the least interference route in a network.

■ MA55

55- Regency Ballroom B - Hyatt

Studies of Consumer Behavior and Inventory Sharing

Cluster: Operations Research in Emerging Economies

Invited Session

Chair: Rachel Zhang, Professor, Hong Kong University of Science and Technology, Dept of IE and LM, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, rzhang@ust.hk

Co-Chair: Shining Wu, The Hong Kong University of Science and Technology, Department of IELM, Kowloon, Hong Kong - PRC, shiningwu@ust.hk

1 - Managing Returns Policy and Product Resale
Yong Lei, Student, Hong Kong University of Science and Technology, Department of IELM, Kowloon, Hong Kong-PRC, ylei@ust.hk, Qian Liu, Stephen Shum

We consider the firm's problem when product can be resold either by firm or by consumers. The firm sells products with returns policy. Consumers with uncertainty about whether the product will fit them decide whether to purchase the products and then whether to return them to the firm or resell directly on their own if the products don't fit their needs. The firm's optimal pricing decision is derived. Furthermore, we demonstrate the consumer resale behavior will generally harm the firm's profit.

2 - Dynamic Pricing and Inventory Control in the Presence of Strategic Consumers with Reference Effects
Shining Wu, The Hong Kong University of Science and Technology, Department of IELM, Kowloon, Hong Kong-PRC, shiningwu@ust.hk, Rachel Zhang

We consider a firm that sells the same versions of the product season after season. At the beginning of each season (stage 1), the firm places an order and sells the product at full price. As the sales unfolds, the firm has an opportunity to mark down the price (stage 2). Such markdowns may motivate strategic consumers to delay purchases in the future. We show that a strategic firm tends to stock less and discount less. Under some conditions, the optimal strategy has a mean-reverting property.

3 - Proactive Transshipment Coupled with Price Commitment Postponement Does More than Stock Balancing
Li Li, HKUST, Department of IELM, Kowloon, Hong Kong-PRC, ielli@ust.hk, Rachel Zhang, Li Jiang

We analyze a setting of two retailers each serving a local market. The retailers can postpone pricing decisions to influence demands until market uncertainties are revealed and have the option to relocate stocks between themselves either before or after price setting. We show that the timing of stock relocation relative to price setting have significant implications retailers to improve service levels and profits, and further investigate their effects on various parties in the network.

■ MA56

56- Curtis A- Hyatt

Performance and Creativity in the Value Chain

Sponsor: Technology Management

Sponsored Session

Chair: Juliana Hsuan, Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, jh.om@cbs.dk

1 - The Use of New Technology during Check-in at Airports
Eric Bentzen, Professor, Copenhagen Business School, Solbjerg Plads 3, Frederiksberg C, DK-2000 F., Denmark, eb.om@cbs.dk, Juliana Hsuan

Smartphone technology replaces the traditional tickets used at check in at airports. The often labour-intensive check in has developed several new ways of improving productivity. Self-service systems have been built and recently smart phones have been introduced as a new way of doing check in.

2 - Vendor Selection, Contract Efficiency, and Performance Measurement in Knowledge Outsourcing
Zhijian Cui, Assistant Professor of Operations Management, IE Business School, Calle de Maria de Molina, 12, Madrid, 28006, Spain, Zhijian.Cui@ie.edu, Sameer Hasija

This study compares the efficiency of some commonly observed vendor selection and contracting mechanisms. We show that good vendor selection and perfect contract efficiency are two fundamentally conflicting goals, unless certain conditions hold. We also highlight the implications of performance-based contracts in knowledge outsourcing.

3 - Creativity Operators and Idea Matrix
Jianxi Luo, New York University-Poly, 5 Metrotech Center, LC401, Brooklyn, NY, United States of America, jluo@nyu.edu, Victor Tang

Despite the importance of creativity to innovation and entrepreneurship, a formal model of idea generation and evaluation is lacking. In this paper, we present a formal introduction of "creativity operators" and formulate them. Then, we propose a formal method for assessing and comparing the creativity of ideas or solutions.

4 - Ripples through the Value Chain: Scope and Profit Co-Evolution as Technology Changes
Claudio Wolter, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, Cwolter@cmu.edu, Michael Jacobides, Francisco Veloso

This paper offers a computational model of heterogeneous firms competing along the value chain. We show how capability variance combines with transaction costs to shape specialization and profitability for the upstream and downstream segments. We then investigate how an upstream cost-saving innovation drives changes in scope and profitability for upstream, downstream, and integrated firms. Its effects can "ripple through" the value chain, affecting profit patterns in counterintuitive ways.

■ MA57

57- Curtis B- Hyatt

Advances in Queuing Theory

Sponsor: Applied Probability

Sponsored Session

Chair: Amy Ward, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089-0809, United States of America, amyward@marshall.usc.edu

1 - A Transient Queueing Model and its Analysis
Harsh Honappa, University of Southern California, Los Angeles, CA, United States of America, honnappa@usc.edu, Rahul Jain, Amy Ward

We introduce a transient queueing model in which service occurs over a finite period, and a finite population of customers arrive. Such models are relevant in diverse application contexts, such as when modeling queueing for a popular concert, a lunch cafeteria, etc.. However, their exact analysis is hard. We develop fluid and diffusion approximations under the assumption that customers sample their arrival time from some given distribution F with compact support, and service times are i.i.d.

2 - A Geospatial Location Problem to Minimize Customer Abandonments
Fang Lu, University of Texas at Austin, 204 E. Dean Keeton St. Stop C2200, Austin, TX, 78712, United States of America, lufang05@gmail.com, John Hasenbein, David Morton

Inspired by a practical geographical detection problem, we examine the problem of locating M/G/k+M type stations on a network in order to minimize abandonments. We develop heuristic algorithms based on M/G/k+M queueing approximations and use detailed simulation models to evaluate and enhance our suggested policies.

3 - Cycle Stealing and Truncation for Reducing Delay in Heavy-tailed Queues
Bacel Maddah, Associate Professor, American University of Beirut, Bliss Street, Beirut, Lebanon, bm05@aub.edu.lb, Eman Nasr, Hadi El-Amine

To reduce delays in multi-server queues, where service times are "heavy-tailed" (highly variable), servers are arranged into two stations in series. Arrivers, who find either station busy, are served at the first station for a maximum time T. Among this demand stream, those with service requirements exceeding T, continue service at the second station. To this truncation scheme, we add "cycle stealing," where an arriver, who finds both stations idle, joins the second station. Analytical and numerical results demonstrate superior performance for carefully tailored values of T.

■ MA58

58- Phoenix East- Hyatt

Healthcare Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Carri Chan, Columbia Business School, 3022 Broadway, Uris 410, New York, NY, United States of America, cwchan@columbia.edu

1 - Determining Optimal Configuration of Hospital Inpatient Rooms in the Presence of Infectious Patients
Tolga Tezcan, University of Rochester, 305 Schlegel Hall, Rochester, NY, 14627, United States of America, tolga.tezcan@simon.rochester.edu, Edieal Pinker

We consider the optimal configuration of hospital inpatient rooms when some of the patients have infectious diseases and need to be isolated. We assume that the demand is random and seasonal. Our solution procedure is based on a stochastic program that uses asymptotic approximations for the system performance under different admission polices. We show the effectiveness of the proposed solution procedure for large systems and derive general insights.

2 - When to use Speedup: An Examination of Intensive Care Units with Readmissions
Galit Yom-Tov, Columbia University, New York, NY, United States of America, gy2185@columbia.edu, Carri Chan, Gabriel Escobar

ICUs provide care for the most critical patients. Often, patient demand exceeds bed availability. In such cases, current ICU patients may be discharged early in order to accommodate more urgent patients. This may increase the likelihood of readmission to the ICU. We examine data of 10 ICUs, showing the extent of this phenomena, and examine how different policies affect ICU availability using a state-dependent queueing network.

3 - Mathematical Models for Hospital Inpatient Flow Management
Pengyi Shi, PhD Student, Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, United States of America, pengyishi@gatech.edu, J.G. "Jim" Dai

Motivated by hospital inpatient flow management, we study a many-server queueing system with arrival being periodic Poisson and servers representing inpatient beds. The system has two critical features: (i) each customer's (patient's) service time depends on admission and discharge times, and the number of nights she stays; and (ii) there are extra delays during the admission and discharge processes. We develop analytical methods to predict the system's time-dependent performances.

4 - Delay Effects on Patient Care
Carri Chan, Columbia Business School, 3022 Broadway, Uris 410, New York, NY, United States of America, cwchan@columbia.edu, Vivek Farias

Most queueing models assume that the service requirements of a job are independent of the state of the queue upon its arrival. In a healthcare setting, this assumption is equivalent to ignoring the effects of delay experienced by a patient awaiting care. This work sets out to understand these delay issues from an operational perspective. We consider how to incorporate these measured delayed effects into a queueing model and characterize approximations to various quantities of interest.

■ MA59

59- Phoenix West- Hyatt

Optimal Control of Stochastic Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Mark Squillante, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com

1 - Matching Supply and Demand: Asymptotics and Insights
Yingdong Lu, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, yingdong@us.ibm.com, Mark Squillante, David Yao

We consider a general class of high-volume, fast moving production-inventory systems with either lost-sales or backorder control. Studying the asymptotic behavior of a random walk with power drift, we provide simple solutions that are close to optimal. We also establish an equivalence between the lost-sales and backorder models when both face a large penalty cost.

2 - New Algorithmic Framework for Lost Sales Models with Large Lead Times
David Goldberg, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, dgoldberg9@isye.gatech.edu, Mark Squillante, Dmitriy Katz, Mayank Sharma, Yingdong Lu

Lost sales inventory models are notoriously difficult to optimize due to the curse of dimensionality. We show that when lead times are large, a simple algorithm performs nearly optimally. The main insight is that when the lead time is large, no algorithm can "beat the uncertainty", so even simple policies perform relatively well. Our main proof technique combines a novel coupling for suprema of random walks with arguments from queueing theory.

3 - Optimal Resource Capacity Management for Stochastic Networks
Ton Dieker, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, ton.dieker@isye.gatech.edu, Soumyadip Ghosh, Mark Squillante

We develop a general framework for determining the optimal resource capacity for each station comprising a stochastic network, motivated by applications arising in computer capacity planning and business process management. In this talk we propose an iterative methodology that relies only on the capability of observing the queue lengths at all network stations given any resource capacity allocation. We theoretically investigate the proposed methodology for single-class Brownian tree networks, and further illustrate the use our methodology and the quality of its results through extensive numerical results.

4 - An Explicit Solution to a Singular Stochastic Optimal Control Problem
Mark Squillante, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com, Mayank Sharma, Yingdong Lu, Xuefeng Gao

We consider a control problem that determines a portfolio of positions in internal and external supply sources employed by an organization to best fulfill uncertain demand and address associated risks. A risk-hedging approach is taken to solve the corresponding stochastic optimal control problem for maximizing expected discounted profit over an infinite horizon. We derive a careful analysis of the behavior of the HJB equation that yields the optimal solution and establishes its core properties.

■ MA60

60- Remington- Hyatt

Air System Performance

Sponsor: Aviation Applications

Sponsored Session

Chair: Martin Dresner, Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States of America, mdresner@rhsmith.umd.edu

1 - Assessing Benefits from Aviation Capacity Investment: An Equilibrium Approach
Bo Zou, University of California at Berkeley, 107E McLaughlin Hall, Berkeley, CA, 94720, United States of America, zoubosoar@gmail.com, Mark Hansen

This talk proposes an equilibrium approach to assess benefits from aviation infrastructure capacity investment. The equilibrium approach models the interplay among passenger demand, fare, flight frequency, and flight delays, and their responses to capacity expansion. We present component models, equilibrium formulation, solution algorithm, and the equilibration process, and compare benefit esitmates using the equilibrium and conventional approaches.

2 - Welfare-based Schedule Design and Fleet Assignment with an Application to a Norwegian Network
Nicole Adler, Hebrew University of Jerusalem, Mount Scopus, Jerusalem, 91905, Israel, msnic@huji.ac.il, Joao Pita

We evaluate the social welfare impact of a publicly supported air transportation network, such as the European PSO or the American EAS. The welfare based integrated flight schedule and fleet assignment optimization model designs a network whose objective is to increase accessibility to sparsely populated regions yet minimize public expenditure. The results distinguish between passenger, airline, airport and government surplus and are applied to the Norwegian PSO network.

3 - Network Carrier Characteristics in the Determination of Passenger Choice
Zuozheng Wang, PhD Candidate, University of Maryland, 3344 Van Munching Hall, College Park, MD, 20742, United States of America, zuowang@rhsmith.umd.edu, Martin Dresner

Determinants of passenger choice are examined between two network carriers on duopoly routes from their common Chicago hub. In particular, we test consumer preference for mainline carrier flights over commuter flights and see whether consumers factor historic flight delay information into their choice between carriers. Our major findings are that both commuter carrier flights and delay history have significant impacts on passenger choice.

4 - Fleet Standardization and Airline Performance
Martin Dresner, Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States of America, mdresner@rhsmith.umd.edu, Li Zou, Chunyan Yu

A standardized fleet helps reduce airline operational costs. However, a standardized fleet may lack flexibility in terms of payload and range given a complex route structure, thus limiting revenue potential. A set of fleet standardization indices for US carriers is developed to examine how standardization affects costs and profitability. Results show that standardization reduces costs but also reduces revenues. The net effect on profitability depends on the cost-revenue tradeoff.

■ MA61

61- Russell- Hyatt

Predictability in Aviation Operations

Sponsor: Aviation Applications

Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, 1173 Martin Hall, College Park, MD, 21044, United States of America, lovell@umd.edu

1 - Quantifying the Benefits of Improved Flight Predictability

Kleoniki Vlachou, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, kvlachou@umd.edu, David Lovell, Michael Ball

In this research we define new flight predictability metrics which will provide a customer centric measurement of system performance. We investigate how airlines set their scheduled block times. We also analyze the benefit of improved flight predictability for the NAS and Identify how NextGen may lead to improved predictability.

2 - Real-time Integrated Airport Surface Movement Controlling

Yu Zhang, University of South Florida, Civil and Environmental Engineering Dept, 4202 East Fowler Ave., Tampa, FL, 33620, United States of America, yuzhang@usf.edu

The basic idea of the real-time integrated airport surface controlling is to determine the sequence and passage times of arrival and departure aircraft at airport surface that minimize total taxi time and maximize runway throughput subject to the operational constraints and safety requirements. It will improve the efficiency of airport utilization and help reduce air pollutant emissions near airports. It will also increase the predictability of flight operations and benefit downstream flows.

3 - An Application of Reliability Analysis to Taxi-out Delay

Tony Diana, Division Manager, NextGen Performance, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC, 20591, United States of America, Tony.Diana@faa.gov, Akira Kondo

The research utilizes reliability analysis to evaluate any performance improvement in taxi-out delay at JFK resulting from taxiway enhancements in 2010. The study shows that the average taxi-out delay minutes declined by half in 2011 compared 2007. Weibull analysis of taxi-delay shows a reduction in the extreme value of delay from 30 to 15 minutes. Finally, reliability analysis can be used for airline practitioners to identify expected taxi-out delay and its variance as unimpeded values.

4 - Enhancing Predictability under Block-time Uncertainty through Flight Prioritization

Lu Hao, University of California Berkeley, 107D McLaughlin Hall, Berkeley, CA, 94720, United States of America, haolu@berkeley.edu, Mark Hansen

Predictability is increasingly recognized as an important performance metric for the NAS. Block time variability is a major impediment to predictability and one potential way to improve it is through departure flight prioritization. In this research we will investigate how departure sequencing can be used to lower block-time variance. We will present algorithms and practical rules to swap departures to reduce block-time variance.

■ MA62

62- Borein A- Hyatt

Experimental and Empirical Auctions Research

Cluster: Auctions

Invited Session

Chair: Elena Katok, Professor, University of Texas Dallas, 800 West Campbell Rd., Richardson, TX, 75080, United States of America, ekatok@psu.edu

1 - Reference Prices and Bidder Heterogeneity in Secondary Market Online B2B Auctions

Wedad Elmaghraby, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States of America, welmaghr@rhsmith.umd.edu, Ali Pilehvar, Anand Gopal

Using data collected from a large wholesale liquidator who runs auctions to sell the bundles of returned goods and excess inventory, we study the behavior of these secondary market B2B auctions. We empirically investigate how formed reference prices by bidders, moderated by bidder heterogeneity, impact their bids.

2 - Multi-sourcing Procurement Auctions with Exogenous Splits

Bernardo Quiroga, PhD Student, The University of Texas at Dallas, 800 W Campbell Rd., Naveen Jindal School of Management, Richardson, TX, 75080, United States of America, bquiroga@psualum.com, Aadhaar Chaturvedi, Elena Katok, Damian Beil

The idea behind multi-sourcing reverse auctions is that those suppliers invited to participate are not simply used to reduce the price of the lowest bidder, but also can get a smaller contract in the event when they are not the lowest bidder. We analyze what happens to the incentives triggered by a mechanism with pre-determined splits in the bidders participating in these markets, using both game theory and human subject experiments.

3 - An Experimental Analysis of Bidding Behavior in Competing Auctions

Thayer Morrill, North Carolina State University, Raleigh, NC, United States of America, thayer_morrill@ncsu.edu, Robert Hammond

Theoretical results predict a focal equilibrium for an auction with simultaneous traders; it is weakly dominant for each bidder to bid on the lowest price unit and submit a bid equal to the price of the second lowest unit. We test how bidders actually formulate their bidding strategies in such a market. Although the above equilibrium is in weakly dominant strategies, it is not unique. We test if this strategy is in fact focal to uncover the nature of bidding behavior marketplaces such as eBay.

■ MA63

63- Borein B- Hyatt

A Behavioral Analysis of Contracts and Institutions

Sponsor: Behavioral Operations

Sponsored Session

Chair: Stephen Leider, Assistant Professor, University of Michigan Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, leider@umich.edu

1 - An Experimental Investigation into the Success or Failure of Joint Ventures

Kyle Hyndman, Assistant Professor, Maastricht University, Tongersestraat 53, Room A4.06, Maastricht, Netherlands, k.hyndman@maastrichtuniversity.nl

Joint ventures between firms are popular, yet studies suggest that the chances of success are 50-50. Reasons for failure include unmet expectations, opportunistic behavior and mistrust. We conduct an experiment to understand the importance of these factors. In our experiment, subjects can choose the length of their interaction and also whether to include an exit clause, allowing subjects to end their relationship. We also investigate the role of communication in enabling successful partnerships.

2 - Long-run Productivity and Motivational Dynamics on an Open Crowdsourcing Platform

Annika Mueller, Harvard University, Boston, MA, United States of America, amueller@fas.harvard.edu, Karim Lakhani, Henry Sauermann, Kevin Boudreau

We study motivation and engagement of contributors on an open crowd-sourcing contest platform over a long period of time across a large number of contests. We find evidence of life-cycles of engagement which differ distinctly depending on contributors' primary source of motivation. The findings suggest that the long term management of crowd sourcing platforms involves more than just achieving a critical mass, namely managing dynamic motivations and attracting new generations of membership.

3 - Contract Special Reference Points in Supply Contracts

Michael Becker-Peth, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, michael.becker-peth@uni-koeln.de, Ulrich Thonemann

Recently many experimental studies have shown that behavioral aspects have to be taken into account when choosing the type of contract and specifying the contract parameters. Building on reference dependent valuation with reference values on contract parameters we can explain different order decisions for contracts which are identical in final outcomes for given order quantities and demand realizations. We show how contract designers can use these insides to design better contracts.

4 - Finding the Hidden Cost of Control

Stephen Leider, Assistant Professor, University of Michigan Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, leider@umich.edu, Judd Kessler

Intrinsic motivation and/or social norms can lead to pro-social behavior in the absence of explicit incentives, while increased monitoring and/or fines can often destroy intrinsic motivation. In this paper we replicate the "hidden cost of control" result of Falk and Kosfeld (2006) for a setting with informal agreements, and demonstrate that the hidden cost is eliminated when the binding minimum affects both parties and reversed when both parties must agree upon the minimum.

■ MA66

66- Ellis West- Hyatt

Quality and Statistical Decision Making in Health Care Applications

Sponsor: Data Mining

Sponsored Session

Chair: Shuai Huang, Assistant Professor, University of South Florida, Tampa, FL, United States of America, shuai.huang.ie@gmail.com

1 - Data Mining Approach for the Study of MRSA Infection in RCHE and Hospital

Yizhen Hai, City University of Hong Kong, Y1618, SEEM&MBE lab, AC1, Kowloon, Hong Kong, Hong Kong-PRC, yizhenhai2@Student.cityu.edu.hk, Vincent CC Cheng, Shui-Yee Wong, Kris Baoqian Pan, Kwok Tsui, Kwok-Yung Yuen

Due to the advancement of data collection technology and computational capability, it is feasible to apply statistical data mining tools in health and medical applications. These models facilitate decision making of treatment, disease surveillance and infection control. In this paper we show that, based on the data generated from the hospital's information system, proper statistical models combined with case-control study could be applied to extract useful knowledge in medical analysis.

2 - Cluster Detection using Minimal Internal Distance

Junjie Cao, City University of Hong Kong, Department of Civil Engineering, 83 Tat Chee Avenue, Kowloon, Hong Kong-PRC, junjie.mail@Student.cityu.edu.hk, Kwok Tsui, Kris Baoqian Pan

Testing the null hypothesis of uniformity against a non-random clustering alternative is an important problem. The scan statistic and density-based clustering methods are commonly used to solve this problem. In this paper, we propose another approach based on the minimal internal distance. In the proposed method, we avoid the scan window shape problem and the detected cluster can be of arbitrary shape. Besides, our method can run automatically and no parameter setting is needed.

3 - Is Automatic Telephonic Assessment Reliable and Valid for Depression Screening and Monitoring?

Shinyi Wu, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240C, Los Angeles, CA, 90089, United States of America, shinyiwu@usc.edu, Pai Liu, Irene Vidyanti, Elizabeth Mendez, Caitlin Hawkins, Kathleen Ell, Jeffrey Guterman

Management of depression requires periodic screening and monitoring to assess symptoms and reduce recurrence. Time-pressured healthcare providers are unable to routinely provide this communication. Automated Telephonic Assessment holds promise for quality and productivity improvement. This research examines the reliability and clinical validity of an ATA system in a depression clinical trial and contributes methods to test ATA quality and identify alternative designs for better care management.

4 - Multi-modality Data Fusion using Sparse Composite Linear Discriminant Analysis

Shuai Huang, Assistant Professor, University of South Florida, Tampa, FL, United States of America, shuai.huang.ie@gmail.com, Jing Li

This research develops a novel method, the sparse composite linear discriminant analysis, to perform feature selection from high-dimensional multi-modality data. An application in identifying alzheimer's disease-related brain regions by fusing PET and MRI images is provided.

■ MA67

67- Ellis East- Hyatt

IIE Transaction Design and Manufacturing Invited Papers

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Shiyu Zhou, Professor, University of Wisconsin, Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, szhou@engr.wisc.edu

1 - Queueing Models for a Single Machine Subject to Multiple Types of Interruptions

Kan Wu, Assistant Professor, Nanyang Technological University, 50 Nanyang Ave., School of MAE, Singapore, 639798, Singapore, kan626@gmail.com, Leon McGinnis

Queueing models are commonly applied to quantify the performance of production systems. Prior research usually focuses on deriving queueing models for a specific type of interruptions. However, machines generally suffer multiple types of interruptions in practical manufacturing systems. To satisfy this need, an integrated model is proposed, in which multiple types of interruptions commonly seen on the shop floors are considered.

2 - Performance Analysis and Design Tradeoffs in Warehouses with Autonomous Vehicle Technology

Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, ME 3258, Madison, WI, United States of America, ananth@engr.wisc.edu, Sunderesh Heragu, Debjit Roy, Charles Malmborg

Autonomous vehicle based storage and retrieval systems present a potential alternative to the traditional technologies used for unit-load warehouse operations. We investigate the performance impact of design decisions such as the configuration of aisles and columns, allocation of resources to zones, and vehicle assignment rules using multi-class semi-open queuing network models. The models are solved using decomposition-based approaches to provide insights useful in design conceptualization.

3 - Simulation-based Estimation of Cycle Time using Quantile Regression

Nan Chen, Assistant Professor, National University of Singapore, Department of Industrial and Systems Eng, 1 Engineering Drive 2, Singapore, 129789, Singapore, isecn@nus.edu.sg, Shiyu Zhou

Production cycle time is an important performance measure, and it is of interest to characterize its distributional properties comprehensively. This article proposes a non-linear quantile regression model for the relationship between stationary cycle time quantiles and the throughput rates of a manufacturing system. The statistical properties of the estimated cycle time quantiles are investigated and the impact of dependent data from simulation output on parameter estimations is analyzed.

4 - Transient Analysis of Serial Production Lines with Bernoulli Machines

Liang Zhang, Assistant Professor, University of Wisconsin-Milwaukee, 3200 N. Cramer Street, EMS 307, Milwaukee, WI, 53211, United States of America, liangzh@uwm.edu, Chuanfeng Wang, Jorge Arinez, Stephan Biller

Transient behavior of production systems has significant practical and theoretical implications. However, analytical methods for production systems during transients remain largely unexplored. In the framework of serial lines with Bernoulli machines and finite buffers, we develop a mathematical model and derive formulas to evaluate important transient performance measures. In addition, an efficient procedure based on recursive aggregation is developed to approximate the transient performance.

■ MA68

68- Suite 312- Hyatt

Markowitz Portfolio Selection for International Investments

Sponsor: Financial Services Section

Sponsored Session

Chair: Seongmoon Kim, Associate Professor, Yonsei University, 50 Yonsei Ro, Seodaemungu, Seoul, 120-749, Korea, Republic of, kimsm@yonsei.ac.kr

1 - Developing Investment Framework based on Markowitz's Portfolio Selection Model Integrated with EWMA

Kyungchan Park, Yonsei University, 50 YonseiRo, SeodaemunGu, Seoul, 120-749, Korea, Republic of, pkc88@hanmail.net, Seongmoon Kim

In applying Markowitz's portfolio selection model to the Korean stock market, we developed an investment framework that combines overall input parameters, such as minimum expected return required, rebalancing period, and key inputs for portfolio theory. Instead of using the conventional SMA, we used EWMA to estimate the key inputs. Our comprehensive framework showed the efficacy of the Markowitz's model by outperforming all four of our benchmarks, during the 2007-2011 global financial crisis.

2 - Performance of the Markowitz's Portfolio Selection Model over the Accuracy of Estimated Values

Hongseon Kim, Yonsei University, 50 YonseiRo, Seodaemungu, Seoul, Korea, Republic of, caasman@gmail.com, Seongmoon Kim

Using financial data in the Korean stock market, this paper empirically analyzes how the difference between estimated and actual values of each stock's expected return, standard deviation, and correlation coefficient might affect overall risk and return of the portfolio. We found that increasing accuracy of the input data, especially, each stock's expected return, had a significant impact on the return of the portfolio.

3 - Portfolio Optimization for Investment in Global Markets, using Markowitz's Portfolio Selection Model

Jongbin Jung, Yonsei University, 50 YonseiRo, Seodaemungu, Seoul, 120-749, Korea, Republic of, olorin@yonsei.ac.kr, Seongmoon Kim

This paper investigates portfolio optimization in various global markets. The proposed model is based on Markowitz's portfolio selection model, uses an exponential smoothing forecast method to improve parameter estimates, and incorporates fine-tuned adjustments for different markets around the world. The performance of the model is evaluated against benchmark indices in each respective market. (e.g. Dow Jones Industrial Average, FTSE).

■ MA69

69- Suite 314- Hyatt

Risk Measurement in Financial Markets

Cluster: Optimization in Finance

Invited Session

Chair: Dan Iancu, Assistant Professor, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States of America, daniancu@stanford.edu

1 - Systemic Risk and Stability in Financial Networks

Alireza Tahbaz-Salehi, Columbia Business School, 3022 Broadway, Uris Hall 418, New York, NY, 10027, United States of America, alirezat@columbia.edu, Daron Acemoglu, Asuman Ozdaglar

We argue that contagion in financial networks exhibits a form of phase transition as interbank connections increase: as long as the magnitude and the number of negative shocks affecting financial institutions are sufficiently small, more "complete" interbank claims enhance the stability of the system. However, beyond a certain point, such interconnections start to serve as a mechanism for propagation of shocks and hence, lead to a more fragile financial system.

2 - Factor-based Risk Decomposition

Chen Chen, Doctoral Student, Columbia University, 325, SW Mudd Building, 500 W. 120th S, New York, United States of America, cc3136@columbia.edu, Garud Iyengar, Ciamac Moallemi

The risk of a system can arise from a variety of factors that influence future outcomes. We develop a statistical methodology to explain the risk exposure created by a set of factors, and to identify the factors which are most systemically important.

3 - Tight Approximations of Dynamic Comonotonic Risk Measures

Dan Iancu, Assistant Professor, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States of America, daniancu@stanford.edu, Dharmashankar Subramanian, Pu Huang, Marek Petrik

We compare two frameworks for measuring dynamic risk: (1) involves a static risk measure,and (2) uses a (time-consistent) compositional risk measure. We characterize the tightest multiplicative factor approximation of the former measure by means of the latter. We show that computing the approximation factors is generally NP hard; for the case of CVAR under a uniform measure, we provide analytical expressions for a two-period case, and a polynomial-time algorithm for the general (multi-period) case.

■ MA70

70- Suite 316- Hyatt

Economic Value of Information Systems

Sponsor: Information Systems

Sponsored Session

Chair: Lin Hao, Assistant Professor, University of Notre Dame, Mendoza College of Business, Notre Dame, IN, 46556, United States of America, lhao@nd.edu

1 - Optimal Design of Consumer Review Systems

Hong Guo, Assistant Professor, University of Notre Dame, 356 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, hguo@nd.edu, Yabing Jiang

This paper aims to analyze the design of consumer review systems as firms' strategic decision to facilitate consumer sharing and learning. We show that firms' optimal pricing and review system design decisions critically depend on contextual characteristics. Our results suggest that firms choose a low rating scale for niche products and a high rating scale for popular products. Different pricing strategies should be deployed during the initial sale period for different product types.

2 - How to Design the Incentive Structure of Crowdsourcing Contest: A Structural Empirical Analysis

Yan Huang, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, yanhuang@andrew.cmu.edu, Tridas Mukhopadhyay, Param Singh

We develop a dynamic structural model of user participation in crowdsourcing-contests and present empirical evidence on how incentive structure could affect the quality of solutions. Using data from Threadless.com, we find that participants exert less effort as competition for the reward increases. In our policy simulations, we evaluate the impact of alternative incentive structures on users' participation decisions and the effort they exert in their submissions.

3 - Quantifying Peer Influence in an Online Music Community

Yijen Ho, The Paul Merage School of Business, University of California-Irvine, Irvine, CA, United States of America, hoy1@uci.edu, Jui Ramaprasad, Sanjeev Dewan

We study the role of peer influence on consumption in an online music community. We use instrumental variables based on intransitive triads to distill the effect of influence from that of unobserved user heterogeneity. Our preliminary results suggest that peer influence is a significant driver of both music discovery and subsequent listening behavior. Our analysis also sheds light on differences in the level of peer influence across music and user types, and the dynamics of network co-evolution.

4 - An Empirical Analysis of Conversion Rate Dynamics in Online Retail

Lin Hao, Assistant Professor, University of Notre Dame, Mendoza College of Business, Notre Dame, IN, 46556, United States of America, lhao@nd.edu, Ming Fan, Yong Tan

This paper studies how online seller's pricing and product strategies, marketing efforts and service quality, together with reputation scores and ratings, affect conversion rates. We use a dataset from a popular online marketplace. Our estimation results show that there exist multiple states that affect the conversion rates. The relationship between conversion rate and above related factors are state dependent.

■ MA71

71- Suite 318- Hyatt

Contracts and Pricing in Information Systems

Sponsor: eBusiness

Sponsored Session

Chair: Shivendu Shivendu, University of California-Irvine, Irvine, CA, United States of America, sshivend@uci.edu

1 - Store Brands and Channel Power

Ruixia Shi, Assistant Professor, University of Richmond, Robins School of Business, 28 Westhampton Way, Richmond, VA, 23229, United States of America, rshi@richmond.edu, Jun Zhang, Jun Ru

This paper relates a retailer's store brand strategy to the relative bargaining powers of channel members. It shows that the store brand becomes less appealing to the retailer and the quality threshold for the store brand to be introduced becomes higher as power shifts from a manufacturer to a retailer.

2 - When is Bundling of Contracts Optimal?

Qiang Zeng, Shantou University, Business School, Guangdong, China, qzeng@stu.edu.cn, Shivendu Shivendu

When contracting out a series of sequential activities in which the quality of outcome of earlier activities impacts the cost to the vendor of the subsequent activities, the firm may offer unbundled contracts wherein she contracts for each activity separately and potentially with two different vendors, or offer bundled contracts to one single vendor for both activities. We study the tradeoffs and examine the optimality of bundling contracts under information asymmetry and uncertainty.

3 - Why Consumers Pay High Prices for Software in China?

Zhe Zhang, University of California Irvine, Business School, Irvine, CA, United States of America, zhez1@uci.edu, Shivendu Shivendu

Software companies adopt heterogeneous product-pricing strategies across different countries. We observe that often software companies' prices of versions are uncorrelated with per-capita income levels and piracy rates. Microsoft Office Business and Office Professional versions are priced much higher in China compared to in US. We unravel this puzzle in our model that the market consists of consumers who are heterogeneous on taste for quality of additional functionality and propensity to pirate.

4 - Service Systems with Postponable Acceptance and Assignment

Keumseok Kang, Florida International University, 11200 SW 8th Street, Miami, FL, 33199, United States of America, kskang@fiu.edu, Kemal Altinkemer, George Shanthikumar

We study the dynamic order acceptance and assignment problem for a service system that provides heterogeneous services using heterogeneous servers. Unlike traditional problems, in our settings, the service system can strategically postpone acceptance and assignment decisions for orders. We formulate this problem using a dynamic and stochastic programming approach, find the structural properties of the optimal policy, propose approximate policies, and conduct extensive computational experiments.

■ MA72

72- Suite 322- Hyatt

Advances in Optimization Modeling Languages and Systems II

Cluster: ICS-Advances in Optimization Modeling Languages and Systems

Invited Session

Chair: Robert Fourer, President, AMPL Optimization, Inc, 2145 Sheridan Road, Evanston, IL, United States of America, 4er@ampl.com

1 - Deploying MPL Optimization Models on Servers and Mobile Platforms

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

The IT industry is currently undergoing a major shift, away from traditional standalone applications, to new platforms such as tablet computers and mobile phones. We will demonstrate a new server-based version of MPL OptiMax, which makes writing mobile applications relatively quick and easy. We will demonstrate how to integrate optimization models seamlessly with online data, and then deploying them on a server for servicing both web and mobile clients, using standard programming languages.

2 - Object Oriented GAMS API: .NET and Beyond

Michael Bussieck, GAMS Development, 1217 Potomac Street NW, Washington, DC, 20007, United States of America, mbussieck@gams.com, Lutz Westermann

The object oriented GAMS API provides the possibility of controlling GAMS from within different programming languages like C#, Java and Python which, for example, offers a seamless integration of GAMS into .NET based applications. The powerful in-memory representation of a GAMS model can increase performance when solving a model multiple times with slightly changed data by performing the model creation only once.

3 - Achieving Optimal Solution Performance for your Optimization Modeling Project

Sandip Pindoria, Maximal Software, United Kingdom, sandip@maximalsoftware.co.uk, Bjarni Kristjansson

When working with real world, large-scale models there are many factors that come into play how to gain the optimum speed. In addition to choosing the correct solver algorithms and tuning solver parameters, other factors include how the model is formulated for sparsity, where the data resides, and what hardware gives best results. In this presentation, we will report on our experiences at Maximal in solving and tuning difficult models for our customers.

4 - Optimization: Seeing is Believing

Peter Nieuwesteeg, Senior AIMMS Specialist, AIMMS (Paragon Decision Technology), 500 108th Avenue NE, Suite 1085, Bellevue, WA, 98004, United States of America, Peter.Nieuwesteeg@aimms.com

"Seeing is Believing" also holds true for optimization. Just saying that it can bring value to your organization is not enough. Your colleagues need to be able to see it. In this presentation, we will show you how to produce visible results, including an overview of our new AIMMS PRO© (Publishing and Remote Optimization) platform. This web-based publishing framework provides a portal for centralized optimization. Once logged in, they will be able to see optimization with their own eyes!

■ MA73

73- Suite 324- Hyatt

Computational Finance II

Cluster: Quantitative Finance

Invited Session

Chair: Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@illinois.edu

Co-Chair: Lingfei Li, Assistant Professor, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong - PRC, lingfeili2012@u.northwestern.edu

1 - Pricing of Path Dependent Claims in Regime Switching Markets

Agostino Capponi, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States of America, capponi@purdue.edu

We obtain a novel Poisson series representation for the arbitrage-free price of vulnerable contingent claims in a regime-switching market. This representation, along with a short-time asymptotic expansion of the claim's price process, yields an efficient method for pricing path dependent claims. The proposed method is demonstrated on a class of path-dependent claims that we term self-decomposable, as well as on the class of vulnerable stock options.

2 - Density Expansion of the SABR Model: A Probabilistic Perspective

Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, Hong Kong-PRC, nchen@se.cuhk.edu.hk, Nian Yang

The SABR stochastic volatility model, introduced by Hagan et al. (2002), yields a good fitting to implied volatility smile curves and captures the correct co-movements between the volatility and the underlying level. In this paper we investigate an innovative probabilistic approach to obtain an almost exact marginal transition density for the underlying price and volatility processes with the help of the time-changed Bessel processes and the watanabe-Yoshida asymptotic expansion theory.

3 - Maximum Likelihood Estimation for Large Interacting Stochastic Systems

Justin Sirignano, Stanford University, 3 Gibbs Court, Irvine, CA, United States of America, jasirign@stanford.edu, Kay Giesecke, Gustavo Schwenkler

Parameter estimation for a large system is facilitated by using the asymptotic SPDE to which the system weakly converges as well as a conditionally Gaussian first-order correction. We develop a particle filtering method for the asymptotic SPDEs. Theoretical convergence of the finite system's likelihood to the asymptotic likelihood is discussed. Important credit risk and mortgage applications motivate the method.

4 - Optimal Stopping and Early Exercise: An Eigenfunction Expansion Approach

Lingfei Li, Assistant Professor, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong-PRC, lingfeili2012@u.northwestern.edu, Vadim Linetsky

We propose an eigenfunction expansion approach to solve discrete time finite and infinite horizon optimal stopping problems for symmetric Markov processes, which cover many models used in practice. We illustrate this approach with some real option applications.

Monday, 11:00am - 12:30pm

■ MB01

01- West 101- CC

Computational Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, School of Business, 100 Institute Rd., Worcester, MA, 01609, United States of America, atrapp@wpi.edu

1 - Parallel Global Optimization using an Improved Multi-points Expected Improvement Criterion

Peter Frazier, Assistant Professor, Cornell University, 106 Burleigh Dr, Ithaca, NY, 14850, United States of America, pf98@cornell.edu, Scott Clark

In the context of parallel global optimization with a Gaussian process prior, we consider the multi-points criterion proposed by Ginsbourger, Le Riche, and Carraro (2008). While this criterion is conceptually appealing, optimizing it to create an algorithm is difficult. Using stochastic approximation, we show how to optimize the multi-points criterion efficiently, and demonstrate that the resulting algorithm provides a speedup over the single-threaded expected improvement algorithm.

2 - Exploiting Convexity in Global Optimization

Aida Khajavirad, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, aida@cmu.edu, Nick Sahinidis

Many nonconvex optimization problems become convex once the domain of a small subset of their variables has been restricted. This situation arises frequently in the context of partitioning-based global optimization algorithms. We equip BARON with an advanced convexity detection tool that checks for convexity in every node of the search tree and utilizes local solvers and specialized algorithms when convexity conditions are met. Extensive computational results will be presented.

3 - Stochastic Control Optimization of a Binary Integer Program

Pengbo Zhang, PhD. Student, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195-2650, United States of America, pbzhang@u.washington.edu, Wolf Kohn, Zelda Zabinsky

We develop a discrete meta-control algorithm that provides a good approximation to large-scale binary integer programs with low polynomial time complexity. The key innovation to our optimal control approach is to map the vector of n binary decision variables into a scalar function defined over a discrete time interval [0, n]. We define a linear quadratic tracking problem and use the necessary conditions for optimality to develop a bang-bang type solution in our algorithmic approach.

4 - Comparing Value Function-Based Approaches to Solving Two-stage Integer Programs

Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, School of Business, 100 Institute Rd., Worcester, MA, 01609, United States of America, atrapp@wpi.edu

Two-stage integer programs with random right-hand sides can be solved via a value function reformulation. Explicit storage of the value function has both advantages and limitations. To overcome such limitations, we discuss theoretical and computational considerations of both level-set and constraint aggregation approaches, and elaborate on conditions under which each approach is effective.

■ MB02

02- West 102 A- CC

Aggregation of Probabilistic Judgments

Sponsor: Decision Analysis

Sponsored Session

Chair: Eric Bickel, Assistant Professor, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, United States of America, ebickel@mail.utexas.edu

1 - Median Aggregation of Expert Distribution Functions

Stephen Hora, University of Southern California, Department of Industrial and Systems Eng, 3710 McClintock Avenue, RTH 314, Los Angeles, CA, 90089, United States of America, hora@price.usc.edu, Benjamin R. Fransen, Natasha Hawkins, Irv Susel

We discuss an approach to aggregating expert judgments when those judgments are given in the form of a distribution function. The method is based on a median filter, is reasonably simple to apply, and has some good properties. For example, both aggregation of probabilities and fractile values are equivalent. The method also has consensus preservation properties. Finally, we examine the impact of the method on calibration and derive an aggregation rule that preserves calibration in certain cases.

2 - Quantifying Two Effects of the Crowds: Size of the Crowd and Individual Contributions

David Budescu, Professor of Psychology, Fordham University, 441 East Fordham Road, Dealy Hall, Bronx, NY, 10458, United States of America, budescu@fordham.edu, Eva Chen, James Marcus

We present new methods designed to measure meaningfully the effects observed in the process of aggregating probabilistic forecasts from multiple judges (the "wisdom of the crowd"). We derive measures of the size of the crowd and the contributions of the various individuals to the crowd. We illustrate them by analyzing responses from the Aggregative Contingent Estimation System (ACES), a forecasting website in which over 2000 judges have provided forecasts for more than 200 events.

3 - Is It Better to Average Probabilities or Quantiles?

Casey Lichtendahl, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, lichtendahlc@darden.virginia.edu, Yael Grushka-Cockayne, Robert L. Winkler

We consider two ways to aggregate expert opinions: the average probability forecast and the average quantile forecast. We examine several analytical properties of these forecasts and compare their ability to harness the wisdom of the crowd. We show that the two average forecasts have the same mean and that the average quantile forecast always has lower variance. We present empirical evidence that the average quantile forecast outperforms the average probability forecast on four scoring rules.

4 - Trimmed and Winsorized Means for Aggregating Probability Forecasts

Victor Richmond Jose, Assitant Professor, Georgetown University, McDonough School of Business, 37th and O Sts NW, Washington, DC, 20057, United States of America, vrj2@georgetown.edu, Yael Grushka-Cockayne, Casey Lichtendahl

The literature on aggregating point forecasts has shown that trimmed & Winsorized means can offer some improvements to the simple mean. Here, we extend this notion to the case of prob forecasts by introducing two simple methods for trimming & Winsorizing. Using data from the SPF, we compare these robust means to the mean and find that therobust means outperform the simple mean when it exhibits underconfidence. We also propose a novel interior approach to deal with the case of overconfidence.

■ MB03

03- West 102 B- CC

Behavioral Responses to Low Probability Events and Near Misses

Sponsor: Decision Analysis

Sponsored Session

Chair: Matthias Seifert, Assistant Professor, IE Business School, Operations & Technology Area, Maria de Molina 12, 5th floor, Madrid, 28006, Spain, Matthias.Seifert@ie.edu

1 - Do Near Misses Impact Reference Points to Produce Risk Seeking Behavioral Responses to Warnings?

Richard John, Associate Professor of Psychology, University of Southern California, Los Angeles, CA, United States of America, richardj@usc.edu, Robin Dillon, Heather Rosoff

We examine how framing of past experiences, in particular near-misses, alters decision makers' reference point. We report behavioral experiments comparing reference points before and after one or more near misses. Results suggest that decision makers are more risk seeking following a near-miss and the related shift in reference point.

2 - Promoters versus Preventers: Near-miss Events and Subsequent Risk Perception

Florian Federspiel, PhD Candidate, IE Business School, Calle Maria de Molina 12, bajo, Madrid, 28006, Spain, ffederspiel.phd2014@Student.ie.edu, Jill Waymire Paine, Matthias Seifert

Our experimental study focuses on changes in perceived risk after having experienced a near-miss event. We distinguish between different kinds of near-misses (salient versus non-salient; small loss versus no loss) and we measure perceived risk using different measures (a direct one and two kinds of utility assessments). We further focus on interaction effects between displaying a promotion versus prevention focus and the risk perception after experiencing the different kinds of near-miss events.

3 - Managing Uncertainty and the Control of Risks in Decision Analysis

Shweta Agarwal, PhD Candidate, LSE, London, United Kingdom, S.Agarwal@lse.ac.uk, Gilberto Montibeller

In Decision Analysis models uncertainties are traditionally treated as external and thus 'uncontrollable'. However, in practice, managers often have levers to manage uncertainty and hence control risks. We propose representing this in influence diagrams as stochastic interventions (changing the probability distribution of state variables) that represent causal influences and model the corresponding probability revision using stochastic matrices. This technique can be useful in risk management.

■ MB04

04- West 102 C- CC

Applied Decision Analysis I

Contributed Session

Chair: John Mamer, Professor, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, D518, Los Angeles, CA, 90064, United States of America, jmamer@anderson.ucla.edu

1 - Decision Analysis to Promote Offshore Wind Development in the United States

Andrea Staid, PhD. Student, Johns Hopkins University, 3400 N Charles St., 313 Ames Hall, Baltimore, MD, 21218, United States of America, staid@jhu.edu, Seth Guikema

The offshore wind industry in the United States is set to take off, and there are several proposed projects on the horizon. We present a framework to analyze the decisions that must be made to maximize the probability of offshore project reliability and success. Decisions regarding grid connection type, turbine type, and farm location are included in this analysis.

2 - Improving Prediction Market Forecasts for Policymaking

Christopher Karvetski, Assistant Professor, IC Fellow, George Mason University, 5400 Nguyen Engineering Bldg., 4400 University Drive, MSN 1G8, Fairfax, VA, 22030, United States of America, ckarvets@gmu.edu, Kenneth Olson

In the first year of an IARPA-funded forecasting challenge, the Daggre prediction market substantially outperformed baseline forecasts on real-world events, as measured by a time-series Brier scoring average. We show that post-processing models can further improve the performance of the Daggre prediction market by up to 15%, in out-of-sample testing. We compare both of Bayesian and classical statistical models for the post-processing or adjusting of forecast time-series.

3 - Optimizing Test Plans to Maximize Correct Selection

Dennis Leber, Mathematical Statistician, NIST, 100 Bureau Drive, MS 8980, Gaithersburg, MD, 20899, United States of America, dennis.leber@nist.gov, Jeffrey Herrmann

When experimental testing is limited, a decision-maker has only uncertain estimates of the true values of an alternative's consequences. This attribute value uncertainty influences the probability of selecting the best alternative. Given a multiattribute preference structure, the optimal allocation of test effort to the uncertain attributes can be determined. This talk will consider planning tests of detection systems for screening individuals and their baggage for radioactive materials.

4 - Making the Best of a Bad Situation: Declining Price Expectations and Resale Price Maintenance

John Mamer, Professor, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, D518, Los Angeles, CA, 90064, United States of America, jmamer@anderson.ucla.edu, Steven Lippman

Technology products markets are often characterized expectations of decreasing prices. We model a sequential sales process in a market wherein each transaction prices sets an upper bound on the next and use our model to analyze the selling strategy of a product distributor selling for a manufacturer. This model offers a rationale for price maintenance policies implemented by the manufacturer as a means of preventing premature exit by the distributor.

■ MB05

05- West 103 A- CC

Joint Session QSR/DM: Predictive Analytics Applications I

Sponsor: Quality, Statistics and Reliability & Data Mining

Sponsored Session

Chair: Irad Ben-Gal, Professor, Tel Aviv University, Department Industrial Eng Tel Aviv University, Tel Aviv, Israel, bengal@tau.ac.il

1 - Analytics of Faults

Irad Ben-Gal, Professor, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, bengal@eng.tau.ac.il

We consider a system which is inspected by a set of given sensors. The sensors' signature, which is prone to inspection error, enables to classify the system state and decide whether it is reliable, or needs certain preventive maintenance action. We study the performance of the analytics policy under different inspection and malfunctioning scenarios. We use both Rough Set Theory and Error Correcting Codes measures for this analysis.

2 - Learning Based Construction of Efficient Parallel Decision Trees

Chavatzelet Tryster, Tel Aviv University, Hankin 2/11, Ra'anana, 43213, Israel, cdatryster@gmail.com, Irad Ben-Gal

We propose an algorithm for the construction of efficient coding/decision trees with an objective function of minimizing the average code length. The algorithm has a number of positive points, namely, a non-increasing monotonous efficiency function, and the possibility of taking advantage of parallel processing.

3 - Condition-based Maintenance through Targeted Bayesian Networks

Aviv Gruber, Researcher, Tel Aviv University, 7 Hanotea St., P.O.B. 171, Hadar-Am, 42935, Israel, avivgrub@post.tau.ac.il

We present a failure prediction mechanism, based on a machine-learning application. This mechanism serves as the core of the decision-making step, enabling an efficient use of the existing operational data. This is achieved by accounting for the relations between the operational attributes that are most relevant for failure prediction, through measures from Information Theory. We demonstrate the impact of the proposed approach by presenting an application of freight wagon fleet life-cycle cost-analysis, using Monte Carlo simulation.

■ MB06

06- West 103 B- CC

Joint Session SIM/MSOM: Applications of Simulation and Optimization

Sponsor: Simulation & Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Alp Akcay, PhD Candidate, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu

1 - Inventory Optimization for Large-scale ATO Systems

Willem van Jaarsveld, PhD Student, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, 3000 DR, Netherlands, vanjaarsveld@ese.eur.nl

We study spare parts inventory control at an aircraft component repair shop. Parts are used in multiple component types. Each component type has an availability target: the problem structure resembles an Assemble-To-Order system. We develop an algorithm to optimize inventory policies at the repair shop. Unlike existing algorithms, it can handle the large scale of the problem.

2 - Dynamic Demand Fulfillment in Spare Parts Networks with Multiple Customer Classes

Geert-Jan van Houtum, Full professor, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, G.J.v.Houtum@tue.nl, Moritz Fleischmann, Harold Tiemessen, Eleni Pratsini

We consider heuristics for the real-time demand fulfillment for spare parts networks, where customers are classified by their delivery time constraints. Part requests can be fulfilled from multiple local warehouses via regular deliveries or from externally by an emergency shipment. We develop a dynamic heuristic via an approximate dynamic programming approach. This heuristic is close to optimal, has a low computational complexity, and significantly ourperforms a widely used, static rule.

3 - fl-Guaranteed Joint Service Levels

Alp Akcay, PhD Candidate, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu, Bahar Biller, Sridhar Tayur

We introduce a cost-minimizing, multi-product, joint service-level model that satisfies a target joint service level with a guaranteed probability of fl. We combine computationally tractable approximations for service-level constraints with simulation-based procedures that are easy to implement and obtain asymptotically inventory targets delivering beta-guaranteed joint service levels.

■ MB07

07- West 104 A- CC

Robust Optimization in Data Mining and Machine Learning

Sponsor: Data Mining

Sponsored Session

Chair: Theodore Trafalis, Professor, The University of Oklahoma, 202, West Boyd, Rm 124, Norman, OK, 73019, United States of America, ttrafalis@ou.edu

1 - Uniformly-optimal Stochastic Dual Averaging Methods with Double Projections

Xi Chen, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, xichen@cs.cmu.edu, Javier Peña, Qihang Lin

We propose a stochastic dual averaging method for solving convex regularized optimization. Our approaches adopt two proximal operators for each iteration and the final solution is directly obtained from the proximal operator without an averaging step. With this technique, we achieve a uniformly-optimal convergence rate in expectation for both general convex and strongly convex objective function. The variance for the objective and high probability bounds have also been established.

2 - A Unified Robust Classification Model as Financial Risk Measure Minimization

Akiko Takeda, Associate Professor, Department of Administration Engineering, 3-14-1 Hiyoshi, Kouhoku, Yokohama, Kanagawa, 223-8522, Japan, takeda@ae.keio.ac.jp, Takafumi Kanamori

Recently, we proposed a robust optimization formulation that unifies several machine learning classification models. In this talk, we show that our model, the robust classification model (RCM), is extendable to other learning methods such as regression, novelty detection, etc. The RCM can be regarded as financial risk measure minimization. Based on such interpretation, we show that some RCM has guaranteed generalization performance.

3 - Designing Multivariate Control Charts using Weighted Support Vector Machines

Talayeh Razzaghi, Graduate Student, University of Central Florida, Orlando, FL, United States of America, talayeh.razzaghi@gmail.com, Petros Xanthopoulos

In quality control, automated algorithms are useful for early detection of abnormal patterns and avoidance of system malfunctions. In this work we present an overview of the literature of machine learning techniques used for control chart inspection and propose a modified K chart based on weighted Support Vector Machines (SVM) for unbalanced dataset demonstrating its practical application through sensitivity and specificity analysis.

4 - Models and Algorithms for Distributionally Robust Least Squares Problem

He Zhang, PhD Candidate, & Management Sciences, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, hezhang2012@u.northwestern.edu, Sanjay Mehrotra

We present different robust frameworks using probabilistic ambiguity descriptions of the input data in the least squares problems. The three probability ambiguity descriptions are given by: (1) confidence interval over the first two moments; (2) bounds on the probability measure with moments constraints; (3) Kantorovich probability distance from a given measure. We derive equivalent formulations and show that the resulting optimization problem can be solved efficiently.

■ MB08

08- West 104 B- CC

Joint Session SPPSN/MAS: Humanitarian Logistics and Disaster Response III

Sponsor: Public Programs, Service and Needs & Military Applications

Sponsored Session

Chair: John Coles, PhD Student, University at Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, jbcoles@buffalo.edu

1 - Modeling the Dynamics of Agency-agency Partnerships Before and Following Extreme Events

John Coles, PhD Student, University at Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, jbcoles@buffalo.edu, Jun Zhuang

The objective of our research is to model and analyze the process of partnership creation, length of partnership efficacy, and timing of partnerships conclusion in networks of agencies responding to crises. We plan to create models using game theory and simulation to explore how characteristics of partnerships could be used to predict dynamics in agency investment, commitment length, partnership selection, and exit timing from a crisis.

2 - Imperfect Protection of Multi-state Networks

Hugh Medal, Industrial and Systems Engineering, Mississippi State University, Mississippi State, MS, 39762, United States of America, hmedal@ise.msstate.edu, Ed Pohl, Manuel D. Rossetti

Two assumptions are often made in network protection models: 1) protected elements cannot fail, and 2) unprotected elements exposed to a hazard always fail completely. Challenging these assumptions, we study a problem in which hazards cause capacity degradation of network elements. The post-hazard capacity of an element is a random function of the amount of protection allocated to that element. We present a stochastic programming strategy for this problem.

3 - A Framework for Improving Humanitarian Operational Effectiveness

Christopher Zobel, Professor, Virginia Tech, Department of Business Information Technology, 1007 Pamplin Hall, Blacksburg, VA, 24061-0235, United States of America, czobel@vt.edu, Josey Chacko, Loren Rees

Humanitarian operations are often subject to severe resource and time constraints. In order to make the best use of these limited resources and to incorporate learning into subsequent disaster recovery efforts, the humanitarian efforts need to be evaluated along both quantitative and qualitative measures. This research effort seeks to contribute to the ability to tie together long-term decision-making and policy analysis to create more sustainable and disaster-resilient communities.

4 - An Analysis of Competition and Coalition Fundraising Strategies for Disaster Relief Operations

Fuminori Toyasaki, Assistant Professor, York University, 4700 Keele St., Toronto, ON, M3J 1P3, Canada, toyasaki@yorku.ca, Tina Wakolbinger

Aid agencies involved in disaster relief are currently facing challenges in their environment: increasing demand for disaster relief, increasing competition for donations, and donors who are more demanding in terms of accountability. Aid agencies employ different fundraising strategies to deal with these trends. We explore two prevalent fundraising models: competitive model and coalition model.

■ MB09

09- West 105 A- CC

Finding Efficient and Preferred Solutions in MCDM

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Murat Köksalan, METU, IE Department, METU, Ankara, Turkey, koksalan@ie.metu.edu.tr

1 - Generating All Efficient Solutions for Bi-criteria Multi Resource Assignment Problem

Ozlem Karsu, PhD Student, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, United Kingdom, O.Karabulut@lse.ac.uk, Meral Azizoglu

In this study we consider a multi resource assignment problem. Our aim is to generate all efficient solutions with respect to two criteria: total assignment load and maximum assignment load over all agents. We propose several lower and upper bounds and use them in our optimization and approximation algorithms. The computational results show satisfactory behaviours of our approaches.

2 - Solving Multi-objective Integer Programs using Convex Preference Cones

Banu Lokman, Aalto University, School of Economics, Department of Information, and Service Economy, Helsinki, Finland, banu.lokman@aalto.fi, Murat Köksalan, Pekka Korhonen, Jyrki Wallenius

We develop an interactive algorithm for multi-objective integer programming for an underlying quasiconcave value function. We generate cones to eliminate inferior regions and guarantee to find the most preferred solution. Tests on multi-objective assignment, knapsack, and shortest path problems show that the required pairwise comparisons are reasonable.

3 - Dependencies Among Multiple Quality Responses: Characterization and Aggregation for Prediction

Leman Esra Dolgun, Anadolu University, Industrial Engineering Department, Eskisehir, 26555, Turkey, ledolgun@gmail.com, Gülser Köksal, Nimetullah Burnak

We present results of a structured survey with several quality control experts to characterize preferential and statistical dependencies among multiple quality responses. We then consider aggregation of these responses via Choquet integral for predictive modeling. The method is tested for different dependence situations identified through the survey. We elaborate on design of the reference alternatives to control the number of comparisons required to capture the expertise of the decision maker.

4 - Multiple Objective Picker Routing Problems with Turn Penalties

Melih Çelik, Georgia Institue of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, melihcelik@gatech.edu, Haldun Sural

We consider the problem of routing order pickers in a warehouse with the objectives of travel time and turn minimization. First, we show that the turn minimization problem can be solved in polynomial time. We then go on to propose a polynomial time algorithm that generates the efficient frontier for the biobjective problem that minimizes travel times and the number of turns. Lastly, we treat U-turns as a separate objective and extend our algorithm to handle all three objectives.

■ MB10

10- West 105 B- CC

Multi-period Techniques

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Alan King, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com

1 - Extending Convex Approximation Schemes using Switching Times

Alan King, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com

Optimization of decision problems under uncertainty faces the curse of dimensionality. A frequently used approach (for example in neuro-dynamic programming) is to optimize over a low-dimensional "policy space". The problem is how to extend this policy region to incorporate new directions of solution progress. We discuss a method revise the solution based on the selection of a switching time and show how this can be reduced to a tractable two-stage stochastic programming sub-problem.

2 - An Approximate Solution Method for Large Risk-Averse Markov Decision Processes

Dharmashankar Subramanian, IBM Research, 1101 Kitchawan Rd, Yorktown, NY, 10598, United States of America, dharmash@us.ibm.com, Marek Petrik

Stochastic domains often involve decision makers that are risk averse. We propose and analyze a method for solving large risk-averse MDPs with hybrid continuous-discrete state spaces and continuous action spaces. The proposed method iteratively improves a bound on the value function using the linearity structure of the MDP. We demonstrate the use of the method on a portfolio optimization problem.

3 - Robust Optimal Stopping

Andy Sun, Postdoctoral Researcher, IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, andysun@us.ibm.com, Bo Zhang

The optimal stopping problem is a classic problem in applied probability and stochastic control with many applications. We consider a distribution-free approach to this traditional problem in situations where probability transition information is not available or probability models are not appropriate. We propose models that describe state-transition behaviors in the robust setting and characterize optimal and sub-optimal policies for single-choice and multiple-choice optimal stopping problems.

4 - Managing Uncertain Data at Scale

Robin Lougee, Manager, IBM Research, 1101 Kitchawan Road, Yorktown Heights NY 10598, United State of America,rlougee@us.ibm.com

The IBM Global Technology Outlook explores high-impact, disruptive technologies that will lead to industry-changing products and services over the next three- to ten-year period. This year's study highlighted how making revolutionary use of big data and analytics requires a paradigm shift to manage uncertain data at scale.

■ MB11

11- West 105 C- CC

Theory and Applications of Robust Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Nikos Trichakis, Assistant Professor, Harvard Business School, Boston, MA, United States of America, ntrichakis@hbs.edu

1 - Robust Transient Queueing Theory

Nataly Youssef, Graduate Student, Massachusetts Institute of Technology, 143 Albany St., Apt. 014C, Cambridge, MA, 02139, United States of America, youssefn@mit.edu, Chaithanya Bandi, Dimitris Bertsimas

We study the transient behavior of queueing systems by employing robust optimization as opposed to stochastic analysis by modeling queue primitives using uncertainty sets. We provide closed form solutions for the transient behavior of the departure process, waiting and relaxation times for multi-server and tandem queues under possibly heavy tailed arrivals and services. Our results agree with simulation results while providing qualitative insights lacking from traditional queueing models.

2 - Optimal Mechanism Design for Multi-item Auctions: A Robust Optimization Approach

Chaithanya Bandi, PhD Student, Massachusetts Institute of Technology, 02139, United States of America, cbandi@mit.edu, Dimitris Bertsimas

We propose a robust optimization approach to the problem of auction design for multi-item auctions with budget constrained buyers. We model the unknown valuations using uncertainty sets, constructed using historical information and limit laws of probability theory. In this setting, we characterize the optimal auction extending the work of Myerson to auctions with budgets and correlated valuations. This approach is numerically tractable and is robust to distribution misspecifications.

■ MB12

12- West 106 A- CC

Cutting Planes for Mixed-Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Simge Kucukyavuz, The Ohio State University, 1971 Neil Ave, 210 Baker Systems Building, Columbus, OH, 43210, United States of America, kucukyavuz.2@osu.edu

1 - Minimum Concave Cost Network Flow over a Grid Network

Qie He, Georgia Tech ISyE, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, qie.he@gatech.edu, Shabbir Ahmed, George Nemhauser

We study the minimum cost flow problem over a grid network with a general nonnegative separable concave cost function, which generalizes the lot-sizing problem by allowing multiple sources in the network. We show that the problem is polynomially solvable with one echelon of sources and two echelons of sinks. The analysis relies on an inflow formula of any node under all extreme points of the feasible set, which generalizes Zangwill's result (1969) for the multi-echelon lot-sizing problem.

2 - Semi-continuous Network Flow Problems

Gustavo Angulo, 922 Myrtle St NE, Apt 2, Atlanta, GA, 30309, United States of America, gangulo@gatech.edu, Shabbir Ahmed, Santanu Dey

We consider network flow problems where some of the variables are restricted to be semi-continuous. We introduce the single-node semi-continuous flow set with variable upper bounds as a relaxation. Two particular cases of this set are considered, for which we present complete descriptions of the convex hull in terms of linear inequalities and extended formulations. We study the efficacy of the polyhedral results on a class of semi-continuous transportation problems.

3 - Multicommodity Variable Upper Bound Flow Models

Deon Burchett, PhD Student, University of Florida, 406-A Weil Hall, Gainesville, FL, 32608, United States of America, deonlb@hotmail.com, Jean-Philippe Richard

Variable upper bound flow models are well studied in the mixed-integer programming literature, and their study has yielded inequalities that are useful in computation. We consider a multi-commodity generalization of variable upper bound flow models. We perform a polyhedral study of this extended model, investigating novel aspects of its structure while also examining its relationship to the single-commodity case.

4 - Valid Inequalities for Some Generalizations of the Continuous Mixing Set

Manish Bansal, PhD Student, Texas A&M University, Emerging Technologies Building, 3131 TAMU, College Station, TX, 77840, United States of America, bans1571@neo.tamu.edu, Kiavash Kianfar

We present our progress in studying some interesting generalizations of the continuous mixing set previously studied by Van Vyve (2005). We present new valid inequalities for these sets and discuss their facet-defining properties.

■ MB13

13- West 106 B- CC

Gradient Methods for Large-scale Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Peter Richtarik, University of Edinburgh, 6317 JCMB, King's Buildings, Edinburgh, EH93JZ, United Kingdom, peter.richtarik@ed.ac.uk

1 - Parallel Block Coordinate Descent Methods for Huge-scale Partially Separable Problems

Peter Richtarik, University of Edinburgh, 6317 JCMB, King's Buildings, Edinburgh, EH93JZ, United Kingdom, peter.richtarik@ed.ac.uk, Martin Takac

We show that randomized block coordinate descent methods can be accelerated by parallelization when applied to the problem of minimizing the sum of a partially block separable smooth convex function and a simple block separable convex function. The speedup increases with the number of processors and with the degree of partial separability of the smooth component of the objective function. We conclude with some encouraging computational results on huge-scale LASSO instances.

2 - Intermediate Gradient Methods for Smooth Convex Optimization Problems with Inexact Oracle

Olivier Devolder, Université Catholique de Louvain (UCL), 34 Voie du Roman Pays, Louvain-la-Neuve, 1348, Belgium, olivier.devolder@uclouvain.be, FranÁois Glineur, Yurii Nesterov

Between the slow but robust gradient method and the fast but sensitive to errors fast gradient method, we develop new intermediate gradient methods for smooth convex optimization problems. We show, theoretically and on numerical experiments, that these new intermediate first-order methods can be used in order to accelerate the minimization of a smooth convex function when only inexact first-order information is available.

3 - Distributed Block Coordinate Descent Method: Iteration Complexity and Efficient Hybrid Implementation

Martin Takac, University of Edinburgh, Edinburgh, EH93JZ, United Kingdom, M.Takac@sms.ed.ac.uk, Peter Richtarik

In this work we propose solving huge-scale instances of regularized convex minimization problems using a distributed block coordinate descent method. We analyze the iteration complexity of the algorithm and show how it depends on the way the problem data is partitioned to the nodes. Several variations of the basic method are obtained based on the way updates are handled. We report encouraging numerical results for an efficient hybrid MPI + Open MP implementation applied to sparse SVM.

4 - Stochastic First- and Zeroth-order Methods for Nonconvex Stochastic Programming

Guanghui Lan, University of Florida, P.O. Box 210020, Gainesville, FL, 32603, United States of America, glan@ise.ufl.edu, Saeed Ghadimi

We present a new stochastic approximation type algorithm, namely the randomized stochastic gradient method, for solving a class of nonlinear (possibly nonconvex) stochastic programming problems. We establish the rate of convergence of the method for computing an approximate stationary point of a nonlinear programming problem. This method is then specialized for solving a class of simulation-based optimization problems in which only stochastic zeroth-order information is available.

■ MB14

14- West 106 C- CC

Supply Chain Optimization

Cluster: Scheduling and Project Management

Invited Session

Chair: Lei Lei, Professor, Rutgers University, 1 Washington Park, Room 968, Newark, NJ, 07102, United States of America, llei@business.rutgers.edu

1 - A Demand Distribution-free Analysis of Process Flexibility Design

Tianhu Deng, University of California-Berkeley, Berkeley, CA, 94720, United States of America, dthacyj@gmail.com, Z. Max Shen

We discuss a distribution-free analysis of flexibility design problems. We investigate the worst-case performance among all demand distributions that have the given mean and variance. The analysis draws implications about the first and second order effects of plant capacity, demand mean and standard deviation.

2 - Inventory Optimization in Clinical Trial Supply Chains
Yao Zhao, Associate Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, yaozhao@andromeda.rutgers.edu, Anh Ninh, Adam Fleischhacker

One bottleneck in clinical trials is the slow patient recruitment. Companies typically address this issue by recruiting patients globally, which, however, resulted in significant overages of clinical supplies. In this study, we introduce a class of mathematic models to capture the unique attributes of clinical trial supply chains. We show how to optimally position inventory in such supply chains, and test the effectiveness of the model in a real-world example.

3 - Managing Engineering Design for Competitive Sourcing in Closed-loop Supply Chains
Tolga Aydinliyim, Lundquist College of Business, University of Oregon, Eugene, OR, 97403, United States of America, tolga@uoregon.edu

We study the design (integral vs. partitioned) and procurement decisions of a buyer and its suppliers' pricing decisions. The integral design requires more virgin materials and eliminates yield loss due to final joining. However, the simpler partitioned design allows a more competitive supplier base to rely less on reverse flows.

4 - Supply Chain Scheduling with Renewable and Non-renewable Resources
Michael Pinedo, Professor and Chair, New York University, Stern School of Business, 44 West 4th Street, New York, NY, 10012, United States of America, mpinedo@stern.nyu.edu, Lei Lei, Shengbin Wang, Kangbok Lee

When supply chain operations scheduling is subject to both renewable and nonrenewable resource constraints, solving the resulting problems to optimality, especially those involving additional constraints, becomes very difficult. We present three polynomial-time solvable cases, and also a heuristic algorithm for the general case.

■ MB15

15- West 202- CC

Software Demonstration

Invited Session

1 – Gurobi Optimizer for Client-Server Applications
Greg Glockner, Gurobi Optimization, Inc., Box 1001, 3733-1 Westheimer Road, Houston TX 77027, United States of America, glockner@gurobi.com

Client-server, multi-tier and cloud computing are popular methods in software engineering for high-volume or high-availability applications. We will discuss how this applies to optimization and see some optimization applications that can benefit from these architectures. Finally, we'll preview upcoming Gurobi features for client-server software applications.

2 - AIMMS- From Desktop to Network: Rolling Out AIMMS-Based Optimization Models
Peter Nieuwesteeg, AIMMS (Paragon Decision Technology), 500 108th Avenue NE, Sutie 1085, Bellevue WA 98004, United States of America, Peter.Nieuwesteeg@aimms.com, Deanne Zhang

AIMMS already makes it easy for you to build your optimization models and create a versatile user interface. With our just-released AIMMS PRO framework, you can now publish your AIMMS application in your own "App Store," allowing end-users to start the client application anywhere on the network, while the heavy lifting is done on the server. We will show how this client-server setup - combined with automated queuing - allows for efficient what-if analysis. Seeing is believing–come see for yourself!

■ MB16

16- West 207- CC

Clearing Functions, Variable Lead Times and Delay Equations in Production Planning

Cluster: Tutorials

Invited Session

Chair: Dieter Armbruster, Professor, Arizona State University, Tempe, AZ, United States of America, armbruster@asu.edu

1 - Clearing Functions, Variable Lead Times and Delay Equations in Production Planning
Dieter Armbruster, Professor, Arizona State University, Tempe AZ, United States of America, armbruster@asu.edu, Reza Uzsoy

We consider the problem of representing the capabilities of production systems to convert inputs into outputs over time in the face of deterministic demand. The fact that planning models generally operate in discrete-time while the factory being modeled operates in continuous time suggests the use of multimodel methods combining an optimization model that plans the releases into the plant over time with a simulation model that assesses the impacts of these releases on performance. We discuss several such schemes that have been implemented using discrete-event simulation, present recent computational results, and discuss their strengths and weaknesses. We then consider two alternative approaches that have emerged in the recent literature: the use of discrete-time linear programming models based on nonlinear clearing functions, and methods using systems of coupled partial differential equations based on transport phenomena. We identify the relationships between queueing models, clearing functions, and transport model-based methods, and discuss future research directions.

■ MB17

17- West 207 –CC

INFORMS Strategic Initiatives in Analytics

Cluster: Analytics

Invited Session

Chair: Anne Robinson, Director, Supply Chain Strategy and Analytics, Verizon Wireless, Basking Ridge NJ, United States of America, Anne.Robinson@VerizonWireless.com, Jack Levis

1 – Strategic Intiatitives in Analytics
Anne Robinson, Director, Supply Chain Strategy and Analytics, Verizon Wireless, Basking Ridge, NJ, United States of America, Anne.Robinson@VerizonWireless.com

Anne Robinson, President-Elect of INFORMS, and other committee members will provide information about multiple INFORMS analytics-related strategic priorities and goals in this talk. Topics such as certification, continuing education, and outreach will be covered.

■ MB18

18- West 208 A- CC

Advances in Simulation

Contributed Session

Thomas Kirschenmann, Graduate Research Assistant, University of Texas at Austin, 5217 Old Spicewood Springs Rd, Apt 501, Austin TX 78731, United States of America, thk3421@ices.utexas.edu

1 - Improving the Asmussen-Kroese Type Simulation Estimators
Samim Ghamami, University of Southern California, Los Angeles, CA, United States of America, ghamami@usc.edu, Sheldon Ross

Asmussen-Kroese (2006) Monte Carlo estimators of $P(S_n > u)$ and $P(S_N > u)$ are known to work well in rare event settings when S_n is the sum of n i.i.d heavy-tailed random variables, and N is a non-negative integer-valued random variable independent of the X_i. In this paper we show how to improve the Asmussen-Kroese estimators of both probabilities when the X_i are non-negative.

2 - Modeling and Simulating Nonstationary Point Processes having a Constant Variance-to-mean Ratio
Ran Liu, North Carolina State University, 2500 Stinson Drive, Burling Lab, Raleigh, NC, 27695, United States of America, rliu3@ncsu.edu, James Wilson

We survey various methods for modeling and simulating nonstationary point processes having a constant variance-to-mean ratio including nonhomogeneous Poisson processes and recent research on inversion and thinning methods for modeling and simulating nonstationary non-Poisson arrival processes. We propose a Combined Inversion-And-Thinning method for simulating these processes that avoids the disadvantages while retaining the advantages of each method.

3 - A Complete Bayesian Analysis of the Modified and Exponentiated Weibull Distributions
Thomas Kirschenmann, Graduate Research Assistant, University of Texas at Austin, 5217 Old Spicewood Springs Rd, Apt 501, Austin, TX, 78731, United States of America, thk3421@ices.utexas.edu, Elmira Popova, Paul Damien, Stephen Walker

This project provides the first complete Bayesian analysis of the exponentiated and modified Weibull distributions which are useful largely due to flexible hazard rate functions. For both models, a slice sampling method is employed to create a Gibbs sampler that intelligently slices the parameter space to sample only from posterior densities that have the desired hazard shape. These methods are tested with artificial data as well as real-world data from a nuclear power plant in Texas.

4 - Solving Large-scale Random Linear Programs via Sequential Statistical Approximation

Kuo-Hao Chang, Assistant Professor, National Tsing Hua University, No. 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan-ROC, chang@mx.nthu.edu.tw

We develop efficient methods for handling large-scale random linear programs, in which the technology coefficients are random variables, and can be estimated by stochastic simulation. We prove that the developed methodology can achieve any desired level of optimality gap and feasibility confidence. Numerical experiments show the developed method is much computational efficient than existing approaches.

■ MB19

19- West 211 A- CC

Simulation in Health Care

Contributed Session

Chair: R. Logen Logendran, Professor, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, Logen.Logendran@oregonstate.edu

1 - Exploring Workflow Patterns in Emergency Departments

Mustafa Ozkaynak, Postdoctoral Fellow, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA, United States of America, mozkaynak@wpi.edu, Patricia Brennan

Emergency Departments (ED) in the US are facing a national crisis. Relevant research suggests looking at ED care processes and modifying them as needed to improve their efficiency and effectiveness. We conducted a field study in three hospital EDs and captured early stages of 108 patient care episodes. We identified six patterns. These patterns may inform the design, implementation and evaluation of systematic engineering interventions that will lead to lower cost and higher quality of care.

2 - Use of Discrete Event Simulation in Redesign of Internal Medicine Outpatient Clinic

Tarun Mohan Lal, Health Systems Engineering Analyst, Mayo Clinic, 155 First Avenue SW, Centerplace Building, Floor 6, Room 04, Rochester, MN, 55901, United States of America, mohanlal.tarun@mayo.edu

General Internal Medicine at Mayo Clinic was considering moving from a regular exam room to Jack and Jill/Suites (combination of 2 consult rooms and 1 exam room) layout based on patient feedback. This change would potentially impact the capacity needs, processes and efficiencies of the clinic. Purpose of this presentation will be to discuss how simulation modeling was used to study the operational impacts of the change and in developing new processes for successful implementation.

3 - Using Operations Research to Predict and Reduce Deteriorating Patients in Hospitals

Todd Huschka, Master Health Systems Analyst III, Mayo Clinic, 200 1st St. SW, Rochester, MN, 55905, United States of America, huschka.todd@mayo.edu, Thomas Rohleder, Jeanne Huddleston, Bruce Morlan, Matthew Johnson

Understanding the health path a patient takes during a hospitalization is important to reduce serious events, including death. Using operations research we will look at the possibility of predicting a deteriorating patient before the patient has a serious event, including death. Simulation of the process will evaluate how predicted increased monitoring of patients will affect overall hospital resource needs.

4 - Discrete Event Generation from the Dynamic Model of Deformable Organs for Laparoscopic Simulation

Seyoun Park, Research Professor, University of Ulsan College of Medicine, Asan Medical Center, Pungnap2-dong, Songpa-gu, Seoul, Korea, Republic of, Seyoun.Park@gmail.com, Joohoe Kong, Byung K. Choi, Hayong Shin, JoonChul Park

In general, deformation, physical state change of organs by surgery instruments is a continuous model such as a differential equation while surgical procedures are discrete event models. To interoperate two different models in one simulation system, we use an timer embedded FSM for modeling of scenarios and an rule-based event generator to check conditions and generate events from organ states. A simulation engine advances time steps of two models, generates events and passes them as messages.

5 - Joint Optimization of Allocation and Release Policy Decisions for Surgical Block Time

Mina Loghavi, University of Tennessee, The College of Business Administration, Knoxville, TN, 37996, United States of America, mloghavi@utk.edu, Charles Noon

In practice, block time is usually allocated without considering the stochastic nature of case demand and duration. Once allocated, the release policies (if used) are often less-than-optimal simple rules. Although previous research has examined these decisions individually, we consider them jointly using a multi-objective model. Financial, temporal, & clinical measures are embedded within a sim/opt framework to evaluate current practices and identify improved, yet practicable, approaches.

■ MB20

20- West 211 B- CC

George B. Dantzig Dissertation Prize II

Cluster: George B. Dantzig Dissertation Prize

Invited Session

Chair: Aliza R. Heching, IBM TJ Watson Research Center, Mathematical Sciences, Yorktown Heights, NY, 10598, United States of America, ahechi@us.ibm.com

1 - George B. Dantzig Dissertation Prize

Aliza R. Heching, IBM TJ Watson Research Center, Mathematical Sciences, Yorktown Heights, NY, 10598, United States of America, ahechi@us.ibm.com

The George B. Dantzig Disseration Award recognizes dissertations that are relevant to the practice of operations research and the management sciences. The award is designed to support greater interaction between academia and the world of practice by awarding research that combines development of novel methodology and new techniques with creative application in a practical real-world setting. Problem scope and potential magnitude of impact of research are considered. In this session, the award finalists will present their research.

■ MB21

21- West 212 A- CC

Network Optimization I

Sponsor: Optimization/Networks

Sponsored Session

Chair: R. Ravi, Carnegie Bosch Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ravi@andrew.cmu.edu

1 - A Branch and Bound Algorithm based on Approximate Binary Decision Diagrams

Andre Cire, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, acire@andrew.cmu.edu, David Bergman, Willem-Jan van Hoeve, J.N. Hooker

In this talk we discuss a novel branch and bound algorithm based on approximate Binary Decision Diagrams (BDDs). We discuss how approximate BDDs can be used to generate upper and lower bounds for combinatorial optimization problems in the form of relaxation and restriction BDDs. We apply the ideas to the well-studied Maximum Independent Set Problem. Experiments show that the proposed branch and bound algorithm outperforms state-of-the-art integer programming technology on this problem domain.

2 - Bounds from Multiple Binary Decision Diagrams

David Bergman, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, dbergman@andrew.cmu.edu, Willem-Jan van Hoeve, J.N. Hooker, Andre Cire

In this talk we discuss the use of multiple Binary Decision Diagrams (BDDs) for the purpose of generating bounds to discrete optimization problems. Individual BDDs are used to generate relaxations for different portions of the problem. From each BDD we derive a flow polytope and then link the BDDs via variables associated with the layers of the individual BDDs. We apply the technique to the Maximum Independent Set and Vertex Coloring problems.

3 - Approximation Algorithms for Generalized Hypergraph Matching Problems

Ojas Parekh, Senior Member Technical Staff, Sandia National Laboratories, MS 1326, Albuquerque, NM, 87185, United States of America, odparek@sandia.gov, Dave Pritchard

We examine two generalizations of the matching problem on hypergraphs with sets of size at most k. Our first result is a (k-1+1/k)-approximation for b-matching on k-hypergraphs, settling the integrality gap of the natural LP relaxation. Our second result is for demand matching on k-hypergraphs. Previously a 2k-approximation was known via iterative packing, and we show that a much simpler and faster local ratio algorithm gives the same result.

4 - Science and Engineering of Co-evolving Networks: Population Dynamics, Epidemics and Crisis Response
Madhav Marathe, Professor, Virgnia Tech, Virginia Bio-Informatics Inst., 1880 Pratt Drive Building XV, Blacksburg, VA, 24061, United States of America, mmarathe@vbi.vt.edu, Stephen Eubank, Anil Vullikanti

Complex Networks are pervasive in our society. Recent quantitative changes in high performance and pervasive computing have created new opportunities for collecting, integrating, and analyzing information related to such networks. The talk will a high performance computing based crises management system called Comprehensive National Incident Management System (CNIMS). Applications to pandemic planning and other large scale human-initiated crisis will be discussed.

■ MB22

22- West 212 B- CC

COIN-OR Technology Forum

Sponsor: Computing Society

Sponsored Session

Chair: Matthew Saltzman, Associate Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634, United States of America, mjs@clemson.edu

1 - Panel: COIN-OR Technology Forum
Matthew Saltzman, Associate Professor, Clemson University, Mathematical Sciences Department, Martin Hall, Box 340975, Clemson, SC, 29634, United States of America, mjs@clemson.edu, Bradley Bell, William E. Hart, Kipp Martin, Ted Ralphs

COIN-OR software users, developers, and other interested people are invited to join members of the COIN-OR board of directors and technical council and project managers for an opportunity to discuss recent and future developments within COIN-OR. If you want to get involved, provide feedback, or just learn about COIN-OR, please join us!

■ MB23

23- West 212 C- CC

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS, The Practice Section

Invited Session

Chair: Allen Butler, Daniel H. Wagner Associates, 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Improving Patient Access to Chemotherapy Treatment at Duke Cancer Institute
Brian Denton, Associate Professor, University of Michigan, 2893 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, btdenton@umich.edu, Tracy Gosselin, Amy Boswell, Johnathan Woodall, Edward P. Fitts

We describe how discrete event simulation and optimization methods were used to improve patient flow within a large cancer center. First, we show results from the simulation model that indicate nurses in the chemotherapy infusion center are a significant bottleneck. Next, we describe a mixed integer program that was used to optimize weekly nurse shift scheduling, and how a simulation optimization model was further used to optimize nurse shift start times to minimize average patient waiting time. Finally we summarize the recommendations that were implemented at Duke Cancer Institute.

2 - Automated Bed Assignments in a Complex and Dynamic Hospital Environment
Bex G. Thomas, Researcher, General Electric Global Research Center, 1 Research Center, Niskayuna, NY, 12309, United States of America, thomasb@ge.com, Srinivas Bollapragada, Kunter S. Akbay, David S. Toledano, Peter L. Katlic, Onur I. Dulgeroglu, Dan Yang

Bed management is an important function of any hospital with a big impact on patient care, patient flow and ultimately the hospital operating margin. A key challenge in bed management is optimizing the bed assignments in a complex and dynamic operating environment. We have developed innovative decision support tools with embedded mathematical models to periodically and automatically recommend bed assignments. We have hosted our prototype bed assignment solution as a cloud based application for Mount Sinai Medical Center (MSMC) in New York and improved their hospital operations.

■ MB24

24- West 213 A- CC

Analytical Approaches for Improving Access to Care

Sponsor: Health Applications Society

Sponsored Session

Chair: Beste Kucukyazici, Assistant Professor, McGill University, 1001 Sherbrooke St W, Montreal, QC, H3A 1G5, Canada, bkucukya@mit.edu

1 - The Bed Manager's Dilemma: A Dynamic Bed Assignment Problem
Jacqueline Griffin, Georgia Institute of Technology, Atlanta, GA, United States of America, jackie.griffin@gatech.edu, Pinar Keskinocak

A bed manager balances available capacity with competing requests for beds, accounting for clinical characteristics of the patients and expectations about future supply and demand. We identify structural properties of the bed assignment problem, by modeling the hospital system as a tandem queueing network with multiple customer classes and cross-trained server pools. We develop algorithms for dynamic assignments and test the performance against current hospital practices through simulation.

2 - Fully Adaptive Designs for Clinical Trials: Simultaneous Learning from Multiple Patients
Vishal Ahuja, PhD Candidate, University of Chicago, Booth Business School, Chicago, IL, 60637, United States of America, vahuja@chicagobooth.edu, John Birge

Traditional clinical trials are randomized and the goal is to maximize learning. Adaptive designs, however, use information accrued during the trial. An ideal adaptive design maximizes patient health outcomes without sacrificing any potential learning. We propose such a design, one that fully exploits learning from multiple patients simultaneously. We demonstrate our design's effectiveness on a recent trial. Our design is general and applicable to any MDP setting where learning takes place.

3 - The Primary Care Physician Shortage: Averting a Disaster
Linda Green, Armand G. Erpf Professor, Columbia Business School, 3022 Broadway, 423 Uris Hall, New York, NY, 10027, United States of America, lvg1@columbia.edu, Sergei Savin, Yina Lu

A severe U.S. primary care physician shortage has been forecast for the coming years. However, estimates are based on simple ratios and do not consider patients' ability to get timely access to care. They also do not quantify the impact of emerging new methods of delivering care. We show that implementation of some increasingly popular operational changes can completely offset the projected increase in demand for physician services while increasing access to care.

4 - Stroke Network Design: A Location-allocation Problem
Beste Kucukyazici, Assistant Professor, McGill University, 1001 Sherbrooke St W, Montreal, QC, H3A 1G5, Canada, bkucukya@mit.edu, Mozart Menezes

This study focuses on a design problem of stroke networks that represents the potential trade-off between minimizing transportation time to the hospital and increasing congestion in that hospital, in order to offer an optimized infrastructure that maximizes the overall efficiency of the stroke system. The developed model also allows to study: (i) value of relocating the primary stroke hospitals, and (ii) value of online information flow between hospitals and EMS.

■ MB25

25- West 213 B- CC

Chronic Disease Management

Sponsor: Health Applications Society

Sponsored Session

Chair: M. Reza Skandari, University of British Columbia, 2111 Lower Mall, #2052, Vancouver, BC, V6T1Z4, Canada, reza.skandari@sauder.ubc.ca

1 - Using Analytics to Improve U.S. Prostate Cancer Detection
John Silberholz, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, josilber@mit.edu, Dimitris Bertsimas

American men spend more than $1 billion per year screening for prostate cancer using the Prostate-Specific Antigen (PSA) exam and then performing follow-up diagnostic testing. We use optimization-based decision analysis to improve screening policies, trading off quality-adjusted life years (QALYs) and screening and diagnostic costs. Our policies significantly decrease QALYs lost at no additional screening cost, or alternately maintain health outcomes at much lower cost.

2 - Community-based Chronic Care for Diabetic Patients through Intervention and Prevention

Alireza Boloori, PhD Student of Industrial Engineering, Wayne State University, 4815 Fourth Street, Department of Industrial & Systems Eng, Detroit, MI, 48202, United States of America, alireza.boloori@wayne.edu, Alper Murat, Ratna Babu Chinnam

Existing studies on chronic disease management in community-based health care services does not consider joint effects of intervention and prevention. By jointly considering intervention and prevention activities, we propose a novel approach to improve health outcome and operational efficiency. We develop a finite horizon MDP model for scheduling diabetic patient visits and composition of prevention and intervention activities. We present results for improving quality of care and efficiency.

3 - Merging Prediction Models and Optimization for Optimal Prevention Policy

Leila Zia, Stanford University, 450 Serra Mall, Stanford, CA, 94305, United States of America, leilaz@stanford.edu

This research merges risk prediction and cost-effectiveness analysis to optimally apply an intervention or prevention to the "right" sub-group of patients while considering the potential benefit to each patient and the cost and operating characteristics of the intervention/prevention. In particular, the cost of applying the intervention is assumed non-linear. Using a functional approximation to the ROC curve we can apply optimization methods to maximize the benefit of the intervention policy.

4 - Dynamic Timing of Arteriovenous Fistula (AVF) Creation for Chronic Kidney Disease (CKD) Patients

M. Reza Skandari, University of British Columbia, 2111 Lower Mall, #2052, Vancouver, BC, V6T1Z4, Canada, reza.skandari@sauder.ubc.ca, Nadia Zalunardo, Steven Shechter

Periodic laboratory tests help nephrologists measure the progression of CKD and forecast when hemodialysis (HD) is needed. The superior quality access for HD is via AVF, which needs to be first created and reach maturity before use. We present a decision model that decides if and when to start creating AVF by dynamically updating our understanding of patient's CKD progression based on observations. We then compare this dynamic approach with the best static policy.

■ MB26

26- North 221 A- CC

New Researchers in OM

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Erica Plambeck, Professor, Stanford Graduate School of Business, 655 Knight Way, Stanford, CA, 94305, United States of America, plambeck_erica@gsb.stanford.edu

1 - Greenhouse Gas Emissions Accounting: Allocating Emissions from Processes to Co-Products

Nur Sunar, PhD Candidate, Stanford University, Graduate School of Business, Stanford, CA, United States of America, nsunar@stanford.edu, Erica Plambeck

To implement border adjustment on imports or to evaluate the carbon footprint of a supply chain, one must specify how to allocate the emissions from a process among its co-products. For example, emissions could be allocated in proportion to the economic value or in proportion to the mass of co-products. We investigate the implications of the allocation rule (and flexibility therein) for GHG emissions, firms' profits, and social welfare.

2 - Does Inventory Increase Sales? The Billboard and Scarcity Effect in U.S. Automobile Dealerships

Santiago Gallino, The Wharton School, 3720 Walnut St., Philadelphia, 19104, United States of America, sgallino@wharton.upenn.edu, Gerard Cachon, Marcelo Olivares

Estimating the relationship between inventory and sales is complex for several reasons. One of the main challenges is that inventories are endogenously chosen: inventory levels are chosen by a decision maker in anticipation of sales. To tackle these difficulties we apply a novel procedure to estimate the impact of inventory on sales: We use weather shocks to dealer's inventories, which are exogenous of managerial decisions, to estimate the impact of inventory on sales.

3 - Demand for Durable Goods and Warranties with Possible Product Failures

Jingqi Wang, jingqi-wang@kellogg.northwestern.edu, Ozge Islegen, Baris Ata

We empirically estimate the demand for televisions and warranties considering that products may fail.

4 - Measurement and Improvement of Environmental Performance under Voluntary versus Mandatory Eco-labels

Basak Kalkanci, Massachusetts Insitute of Technology, Cambridge, MA, United States of America, kalkanci@mit.edu, Erica Plambeck, Erjie Ang

When a firm exerts effort to evaluate its social & environmental impacts, it finds opportunities to reduce them (and hence its risks associated with future regulation). We investigate when a firm should learn and disclose its impact (accounting for the response from consumers and investors) and whether policy makers should mandate disclosure. Experimentally, we show that voluntary disclosure can boost sales.

■ MB27

27- North 221 B- CC

Empirical Research in Supply Chain Management and Retail Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Saravanan Kesavan, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27519, United States of America, skesavan@unc.edu

1 - Operational Performance: Does Supplier Network Position Matter?

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Nitish Jain, Karan Girotra

We study the impact of a supplier network position in the buyer-supplier bipartite network on the operational performance of the buyer firm. We construct these networks using a novel data-set of over 25 million import transactions by U.S. firms from global suppliers.

2 - Demand Forecasting with Stockout and Substitution in Textbook Business

Vishal Gaur, Professor, Cornell University, Johnson School, Ithaca, NY, 14853, United States of America, vg77@cornell.edu, Joonkyum Lee, Suresh Muthulingam

We investigate demand forecasting and inventory planning for the textbook business in the presence of stockout and substitution. We use a utility-based choice model to incorporate stockout and substitution behavior based on the sales data for new and used textbooks from the Cornell Store. Our demand forecasting and inventory planning approach outperforms alternative methods. We implement our model as a controlled field experiment at the Cornell Store and find significant operational improvement.

3 - Labor-mix and Flexible Response to Demand Spikes

Saravanan Kesavan, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27519, United States of America, skesavan@unc.edu, Bradley Staats, Wendell Gilland

In this paper, we investigate how labor-mix affects financial performance and service quality. Using data from 451 stores over two years of a large U.S. retailer, we show that the labor-mix of temporary workers exhibits an inverted U-shaped relationship with store profitability and temporary labor-mix is related to lower values of service quality. We also find that employee engagement positively moderates the negative relationship between temporary labor mix and service quality.

4 - Black Friday Pricing and Inventory Managment in Retail

Nikolay Osadchiy, Emory University, Atlanta, GA, United States of America, nikolay.osadchiy@emory.edu, Vishal Gaur

Black Friday sales are used by retailers to generate revenue through selling at discount prices as well as gauge demand for the remainder of the holiday season. Using Bayesian framework we decouple effects of price elasticity and demand signaling and study their implications for inventory and pricing decisions.

■ MB28

28- North 221 C- CC

Supply Chain Optimization

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Retsef Levi, Massachusetts Institute of Technology, 100 Main Street, Building E62-562, Cambridge, MA, United States of America, retsef@mit.edu

1 - Supply Chain Management with Online Customer Selection

Adam Elmachtoub, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, ane@mit.edu, Retsef Levi

We consider a general class of supply chain and logistics problems where customers arrive sequentially, and one has to decide upon arrival whether to accept or reject each customer. The goal is to minimize the total production costs for the accepted customers plus the rejection costs for the rejected customers. We provide several online algorithms for these problems that are provably near optimal. Our algorithms are based on novel uses of re-optimization and cooperative game theory techniques.

2 - Efficiency Analysis for Service Industries with Nonlinear Demand and Congestion Effects

Wei Sun, Massachusetts Institute of Technology, Cambridge, MA, United States of America, sunwei@mit.edu, Georgia Perakis

This work focuses on efficiency analysis of an asymmetric oligopoly with nonlinear demand and nonlinear congestion cost. We derive tight upper and lower bounds on the welfare loss of an oligopoly with respect to its social optimum. We show that the loss depends on the nonlinearity of the demand and cost functions. In addition, it depends on whether one's congestion cost could be influenced by others' output level.

3 - Dynamic Model of Quality-based Competition between Suppliers

Joline Uichanco, Massachusetts Institute of Technology, Cambridge, MA, United States of America, uichanco@mit.edu, Retsef Levi, Georgia Perakis

In many industries, it is critical that suppliers provide components that meet a quality standard. We study two suppliers that use quality to compete for a contract over a time horizon. The contract is awarded based on the relative quality offered by the suppliers. The more contracts the supplier wins, the more likely it will produce components at a low cost at the next period. We model this problem as a stochastic game and suggest allocation schemes that will result in high quality components.

■ MB29

29- North 222 A- CC

Panel Discussion: Bringing O.R. into the 21st Century with Social Networking and Web 2.0 Tools

Sponsor: Computing Society

Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Bringing O.R. into the 21st Century with Social Networking and Web 2.0 Tools

Moderator: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com, Panelists: Paul Rubin, Michael Trick, Laura McLay, Timothy Hopper, Mary Leszczynski

After a brief "who, what, where, how, and why" on major social networking sites for operations researchers, and a synopsis of activity by INFORMS in the social media, the panel will address questions on the current state and future of social media in our field, including how best to use it for personal and professional advancement.

■ MB30

30- North 222 B- CC

OM-Finance Interface

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl

1 - How Inventory Is (Should Be) Financed: Trade Credit in Supply Chains

Song Alex Yang, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, sayang@london.edu, John Birge

As an integrated part of a supply contract, trade credit has intrinsic connections with supply chain contracting and inventory management. Using a model that explicitly captures the interaction of firms' operations decisions and financial risks, this paper attempts to develop a deeper understanding of trade credit from an operational perspective. Using a sample of firm-level data from Compustat, we find that the inventory financing pattern our model predicts exists in a wide range of firms.

2 - The Value of Supply Chain Finance for the Supplier – the Interplay of Two Stochastic Credit Lines

Robert Grueter, EBS University, Konrad-Adenauer-Ring 15, Wiesbaden, Germany, Robert.Grueter@ebs.edu, Margarita Protopappa-Sieke, David Wuttke

Supply chain finance (SCF) is increasingly valued by managers not only because it lowers financing costs of supply chains, but also because it offers financial flexibility to suppliers. In our continuous-time stochastic model we introduce SCF as cost-less stochastic credit line for suppliers. Sensitivity analyses carried out on closed form solutions characterize formally the flexibility value of SCF, providing an explanation for suppliers adopting SCF even in absence of interest rate arbitrage.

3 - Hedging and Sharing Exchange-Rate Risk in a Global Supply Chain

Kun Soo Park, Assistant Professor, KAIST Graduate School of Management, 85 Hoegiro, Dongdaemun-gu, Seoul, 130-722, Korea, Republic of, kunsoo@business.kaist.ac.kr, Kyoung-Kuk Kim

Hedging exchange-rate risk with currency-options contracts and sharing risk with risk-sharing contracts have been popularly used in practice to manage the risk of exchange rate uncertainty in a global supply chain. In this paper, we consider a supply chain with one retailer and one supplier under different currency units and analyze their decisions on hedging and sharing contracts under exchange-rate uncertainty.

4 - Startup Risk Management: An Operational Hedging Perspective

Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl, Sinan Erzurumlu, Nitin Joglekar

We present a framework where SMEs may create an operational hedge against future under-investment problems through their early stage business expansion decisions. We show that, by operational hedging, SMEs may mitigate capital market frictions, enhance their financing options, and create additional value. The decision for creation of such hedges, however, ought to weigh the benefits of reduced marginal cost of capital and the cost of reduced future growth potential against a status quo.

■ MB31

31- North 222 C- CC

Mitigating Supply Chain Risks

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Yehua Wei, Massachusetts Institute of Technology, 60 Wadsworth,10B, Cambridge, MA, 02142, United States of America, y4wei@mit.edu

1 - Improving Supplier Yield with Spillover Risk

Yixuan Xiao, Washington University in St. Louis, St. Louis, MO, 63130, United States of America, xiaoy@wustl.edu, Nan Yang, Yimin Wang

We study manufacturers' supplier improvement efforts with spillover risk. We consider two manufacturers compete in the same market and share a common supplier, which has a production process that is subject to random yield. We model the competition between manufacturers as a two-stage game, and characterize its equilibrium.

2 - Increasing Supply Chain Robustness through Process Flexibility and Strategic Inventory

He Wang, Massachusetts Institute of Techonology, 77 Massachusetts Ave., Rm 1-249, Cambridge, MA, 02139, United States of America, Wanghe@mit.edu, David Simchi-Levi, Yehua Wei

We consider a supply chain with multiple plants producing multiple products, and a plant may fail because of disruptions. The firm can invest in process flexibility and strategic inventory. The robustness is measured by the time that elapses before the strategic inventory is used up. When demand is deterministic, we show that a little process flexibility is very effective in mitigating disruptions. However, the effectiveness decreases with demand uncertainty.

3 - Bullwhip and Reverse Bullwhip Effects under the Rationing Game

Ying Rong, Assistant Professor, Antai College of Economics & Management,Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, 200052, China, yrong@sjtu.edu.cn, Larry Snyder, Z. Max Shen

Under the risk of scarce supply, retailers may compete with each other by increasing their order sizes in the hope of getting a larger portion of the available inventory. We show that the reverse bullwhip effect, in which the retailers' order variance is higher than the capacity variance, occurs between the supplier and the retailers. This result indicates that demand uncertainty can be amplified upstream, while supply uncertainty can propagate downstream.

■ MB32

32- North 223- CC

Bargaining and Trust in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Lauren Xiaoyuan Lu, Assistant Professor, Kenan-Flagler Business School, University of North Carolina at Chapel Hill, Campus Box 3490, Chapel Hill, NC, United States of America, lauren_lu@unc.edu

1 - Supply Chain Contracting under Competition: Bilateral Bargaining vs. Stackelberg

Lauren Xiaoyuan Lu, Assistant Professor, Kenan-Flagler Business School, University of North Carolina at Chapel Hill, Campus Box 3490, Chapel Hill, NC, United States of America, lauren_lu@unc.edu, Qi Feng

We analyze a two-tier supply chain system consisting of two competing manufacturers selling to two competing retailers. We contrast the firms' contracting behaviors in a Stackelberg game, in which a manufacturer offers a take-it-or-leave-it contract to a retailer, with those in a bargaining game, in which the firms bilaterally negotiate contract terms via a process of alternating offers.

2 - Dynamic Bargaining in a Supply Chain with Asymmetric Demand Information

Guoming Lai, University of Texas at Austin, 1 University Station, Austin, TN, United States of America, guoming.lai@mccombs.utexas.edu, Qi Feng, Lauren Xiaoyuan Lu

We study supply contracting with dynamic bargaining under asymmetric information. The buyer knows the demand state (either high or low), while the seller knows only the prior. We characterize a unique equilibrium for a seller-initiating game, where either both buyer types accept the offer immediately, or only one type accepts immediately while the other rejects and counteroffers an acceptable contract. We apply our model to study the effect of demand forecasting accuracy on firm profitability.

3 - Signaling Reciprocity in Supply Chains

Ruth Beer, Phd Candidate, University of Michigan, Ross School of Business, 701 Tappan, Ann Arbor, MI, 48105, United States of America, ruthbeer@umich.edu, Stephen Leider, Hyun-Soo Ahn

The relationship between a buyer and its suppliers is important and often goes beyond the monetary exchange resulted from transactions. We develop a theoretical model that captures acts of reciprocity and reciprocal gains. We show, theoretically and experimentally, that generous acts (e.g., a costly investment that is not required by the buyer) can serve as a signal of reciprocity to the other party and promote more collaborative relationships.

4 - Price Matching Negotiation versus Simultaneous Negotiation

Gangshu Cai, Associate Professor, Santa Clara University, Department of OMIS, Santa Clara, CA, United States of America, Gangshu@gmail.com, Weixin Shang

Price matching negotiation has been seen in practice; however, no theoretical analysis has been yet dedicated to this phenomenon. This article investigates the impact of negotiation schemes on firms via comparing price matching negotiation and simultaneous negotiation in a variety of situations. We find price matching negotiation can outperform simultaneous negotiation for all firms. We also discuss the impact of ownership, asymmetric bargaining power, and the firms' merger incentives.

■ MB33

33- North 224 A- CC

Topics in Sustainable Operations Management

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations

Sponsored Session

Chair: Chonnikarn Fern Jira, Doctoral Candidate, Harvard Business School, Wyss House, Soldiers Field Road, Boston, United States of America, cjira@hbs.edu

1 - The Supply Chain Impact of Environmental Labeling Design

Chonnikarn Fern Jira, Doctoral Candidate, Harvard Business School, Wyss House, Soldiers Field Road, Boston, United States of America, cjira@hbs.edu, David Simchi-Levi

We explore two designs of environmental labels: one where a fixed level of environmental performance is chosen by the retailer and the other where the supplier chooses his environmental performance, which the retailer communicates to consumers. We analyze the optimal levels of environmental performance in these two models under deterministic and stochastic demand. We show that while the two models are equivalent under deterministic demand, they can differ under stochastic demand.

2 - Got Local Food?

Mustafa Tongarlak, Northwestern University, 2001 Sheridan Road, Jacobs Center 550, Evanston, IL, 60208, United States of America, mtongarlak@gmail.com, Deishin Lee, Baris Ata

We study the sourcing tradeoffs of a retailer selling fresh produce. We derive the optimal ordering policy of a retailer from two types of suppliers: 1) mainstream farm with large, stable supply that is located far from the retail store, and 2) local farm with small, uncertain capacity that is located close to the retail store. We show how the retailer's ordering policy affect the utilization of the local farms.

3 - A Comparison of Type I and Type III Eco-labels for Product Carbon Footprints

Tony Craig, Post Doctoral Research Associate, Massachusetts Institute of Technology, 77 Massachusetts Ave., E40-220, Cambridge, MA, 02139, United States of America, tcraig@mit.edu, Edgar Blanco, Yossi Sheffi

Product carbon labels that communicate the carbon footprint of a product have emerged as a popular type of eco-label. However, initial consumer feedback has indicated confusion at this type of label. In this paper we present two models of carbon labels, one based on a Type III eco-label declaring the product's exact carbon footprint and the other on a standard Type I certification-style eco-label. We compare the results of the models on firm profits, emissions reductions, and social welfare.

4 - Heuristic Approaches for the Disassemble-to-order Problem under Binomial Yields

Karl Inderfurth, Professor, University of Magdeburg, Faculty of Economics and Management, Universitaetsplatz 2, Magdeburg, 39106, Germany, inderfurth@ww.uni-magdeburg.de, Sandra Transchel, Ian Langella, Stephanie Vogelgesang

In disassemble-to-order (DTO) systems it is typically assumed that yields from disassembly are either stochastically proportional (SP) or follow a binomial (BI) process. Yield misspecification results in a lower penalty if BI yield is assumed compared to SP assumption. To support BI yield modeling, heuristic approaches are developed and compared that facilitate DTO problem solving for complex real-world product structures.

■ MB34

34- North 224 B- CC

Technology Entrepreneurship

Cluster: New Product Development

Invited Session

Chair: Henry Sauermann, Georgia Institute of Technology, 800 W Peachtree St., Atlanta, GA, United States of America, henry.sauermann@mgt.gatech.edu

1 - The Entrepreneurial Intentions of Founders and Joiners

Henry Sauermann, Georgia Institute of Technology, 800 W Peachtree St., Atlanta, GA, United States of America, henry.sauermann@mgt.gatech.edu, Michael Roach

Using a sample of over 4,000 science and engineering PhD students close to graduation, we provide descriptive insights into founder and joiner intentions and explore similarities as well as differences with respect to three sets of potential antecedents: individual characteristics such as preferences for freedom or risk aversion, characteristics of the social environment, as well as perceived commercial opportunities.

2 - Information Analogies and the Initiation of Product Markets

Jon Eckhardt, Associate Professor, University of Wisconsin School of Business, 5252 Grainger Hall, 975 University Avenue, Madison, WI, 53706, United States of America, jeckhardt@bus.wisc.edu, Joseph Raffiee

In this paper, we test ex ante predictions regarding information conditions that are likely to stimulate the formation of markets in technological niches. We predict that producers are more likely to introduce products in response to proximate or analogous information when available. Using a monthly longitudinal database that captures the software ecosystem that developed for the Palm Handled computer we test and find partial support for our hypotheses.

■ MB35

35- North 225 A- CC

Pricing and Decentralized Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Cathy Xia, Professor, Ohio State University, 210 Baker, 1971 Neil Ave, Columbus, OH, 43210, United States of America, xia.52@osu.edu

1 - Stochastic Knapsack Problem in a Competitive Environment

Yingdong Lu, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, yingdong@us.ibm.com

Multiple sellers competes for the same demand stream over time. Each seller makes pricing decision based on a stochastic knapsack problem incorporated with competitive information. We investigate the monotonicity behavior of each seller's revenue function, as well as its relation with the seller's market position.

2 - Energy Cost Aware Pricing and Resource Management in Cloud

Parijat Dube, IBM, TJ Watson Research Center, Hawthorne, NY, United States of America, pdube@us.ibm.com, Munish Goyal

We consider a competitive model with M application providers each demanding certain slice of resources from the cloud. They obtain base resource slice on long term lease whereas configurable peak resource slice can be purchased on spot. Cloud auctions residual resource capacity at regularly space time intervals thus offering an opportunity for the application owners to monitor application workload and modulate the resource slice dynamically to balance service quality and energy cost.

3 - Decentralized Control Policies for Large-Scale Vehicle Sharing Systems

David George, Operations Research Analyst, Monsanto Company, Maryland Heights, MO, 63146, United States of America, david.k.george@monsanto.com, Cathy Xia

With the increasing scale and complexity of today's vehicle sharing systems, centralized approaches for their management tend to be impractical. In this research, we present a decentralized approach, based on a closed queueing network model, for maintaining balanced vehicle inventories across the network. In addition to decisions of vehicle repositioning and customer admission, our decentralized solution suggests a mechanism for the dynamic pricing of vehicle rentals based on network congestion.

4 - Robust Multi-Arm Bandit Problems

Michael Jong Kim, Postdoctoral Researcher, University of California Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, 94720, United States of America, kimmi@ieor.berkeley.edu, Andrew Lim

We propose a robust formulation of the classic multi-armed bandit problem of Whittle. We show that arms are no longer independent under the worst case model, even if they are independent under the nominal. Robust versions of the Bellman (dynamic programming) equations are derived, and the optimality of a so-called project-by-project retirement (PPR) policy is established. Using the properties of the PPR policy, we show how performance bounds for suboptimal robust policies can be obtained.

■ MB36

36- North 225 B- CC

Industrial Applications of Price Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Andrew Vakhutinsky, Senior Principal Scientist, Oracle Retail Science Group, 10 Van de Graaff Drive, Burlington, MA, 01803, United States of America, andrew.vakhutinsky@oracle.com

1 - Revenue Model: A Hedonic Pricing Method to Estimate the Values of Customer-driven Attributes

Yimin Liu, Technical Expert, Ford Motor Company, 2101 Village Road, Research Center, Dearborn, MI, 48121, United States of America, yliu59@ford.com, Peggy Whalen

With stricter fuel economy regulations and volatility of gasoline prices, it is important for automakers to assess the revenue potential for fuel-efficiency and performance improvements. Consumers in different segments value fuel economy, performance, and size differently. Using a hedonic pricing methodology, this revenue model estimates the value of key customer-driven attributes, such as fuel economy, performance, and size on vehicle pricing in the US market under different gasoline prices.

2 - Multi-period Price Optimization for Grocery Retailers

Maxime Cohen, Massachusetts Institute of Technology, Cambridge, MA, United States of America, maxcohen@mit.edu, Georgia Perakis, Zachary Leung, Andrew Vakhutinsky

Product line pricing is an important business problem faced by retailers. We formulate a time-dependent price optimization problem for merchandise items in a product category, where demand for each item is a nonlinear function of all the prices. We require the prices to lie in a given price ladder and to satisfy business requirements such as sales target, inter-item constraints and store image preservation. We illustrate that the problem is hard and propose and compare various solution methods.

3 - Solving Large Non-linear, Non-convex Discrete Pricing Problems using Randomized Search Algorithm

Kresimir Mihic, Oracle Labs, 500 Oracle Parkway, 5IP2053, Redwood Shores, CA, 94065, United States of America, kresimir.mihic@oracle.com, Paraskevas Yiapanis, Andrew Vakhutinsky, David Vengerov

Randomized Search (RS) is a solution technique that takes advantage of the finite nature of the decision variables to solve currently intractable or hard to solve problems. Because of its intrinsically parallel nature, RS leverages multi-threaded microprocessors and scales almost linearly as thread count is increased. In our current testing, RS has provided a higher quality solution in less time than the leading commercial solver.

4 - Multi-product Markdown Optimization

Anahita Hassanzadeh, Doctoral Student, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, anh509@lehigh.edu, Andrew Vakhutinsky, Kiran Panchamgam

We focus on markdown optimization problem for multiple products with substitutable demands subject to markdown budget and sell-through constraints. We present a mixed integer linear optimization model based on approximation of the underlying demand function and propose a solution approach that runs sufficiently fast for practical applications. We demonstrate how various business rules are addressed and report the results of our computational experiments.

■ MB37

37- North 226 A- CC

Alternative Fuels, Stations, and Vehicles II

Sponsor: Location Analysis

Sponsored Session

Chair: Michael Kuby, Professor, Arizona State University, Tempe, AZ, 85287-5302, United States of America, mikekuby@asu.edu

1 - Spatial Refueling Patterns of Compressed Natural Gas (CNG) Drivers in Southern California

Scott Kelley, PhD Student, Arizona State University, Sch of Geog Sciences & Urban Planning, 975 S. Myrtle Ave., Coor Hall, Tempe, AZ, 85287, United States of America, sbkelley55@gmail.com, Michael Kuby

This study surveyed 259 drivers of compressed natural gas (CNG) vehicles at five stations in greater Los Angeles, and 261 respondents refueling at five nearby gasoline stations. Using GIS, we calculate deviations from shortest paths necessitated by refueling, station service areas, and proximity to home. When faced with a choice, CNG drivers select stations on their way rather than closest to home by a 10:1 margin, an important implication for developing early alt-fuel station networks.

2 - Finding Shortest Paths for Alternative Fuel Vehicles on a Real Road Network

Ozgur Araz, Assistant Professor, University of Nebraska Medical Center, Nebraska Medical Center, Omaha, NE, 68198-4365, United States of America, ozgur.araz@unmc.edu, Michael Kuby, John Fowler, Ismail Capar

We present a solution method to the problem of finding shortest feasible paths for Alternative Fuel Vehicles (AFVs) on a real road network. The proposed solution algorithm first preprocesses the original road network and stores the routes connecting the stations as the edges of the new network. Then, algorithm generates a new feasible network. Lastly, on this feasible network, for any given origin-destination pairs, the well known Floyd's algorithm is applied to find shortest feasible paths.

3 - A Heuristic Approach for the Flow Refueling Location Model Allowing Driver Deviations

Michael Kuby, Professor, Arizona State University, Tempe, AZ, 85287-5302, United States of America, mikekuby@asu.edu, Jong-Geun Kim

The Deviation-Flow Refueling Location Model (DFRLM) locates p stations to maximize covered flows given a driving range of alt-fuel vehicles and ability to detour from shortest paths. Our greedy algorithms build an artificial feasible network in which arcs represent feasible paths between stations, origins, and destinations and then solve a shortest path algorithm on the feasible network. Experiments show the computational efficiency and effect on optimal locations and objective function values.

4 - Planning the Alternative-fuel Station Infrastructure under Demand Uncertainty

Yu-jiun (June) Tsai, Texas A&M University, College Station, TX, United States of America, yjt2009@neo.tamu.edu, Ismail Capar, Jorge Leon

Flow refueling location model (FRLM), which is used to locate a fixed number of fuel stations on a road network , assumes the traffic flow between origin and destination (O-D) pairs known in advance and the fixed traffic flow is estimated. In this work, we propose a new model to address traffic flow uncertainty in the input data instead of point estimates. We utilize a scenario based approach with the objective of maximizing the traffic flow under the worst case scenario.

■ MB38

38- North 226 B- CC

Variability and Quality of Service Processes II

Sponsor: Service Science

Sponsored Session

Chair: Genady Ya Grabarnik, St. John's University, Queens, NY, United States of America, grabarng@stjohns.edu

Co-Chair: Arjun Natarajan, IBM TJ Watson Research, United States of America, arjunn@us.ibm.com

1 - Empowering Decision Makers through Process Data Analysis

Anca Chandra, Research Staff Member, T.J. Watson Research Center, IBM, 650 Harry Rd, San Jose, CA, 95120, United States of America, anca@us.ibm.com, Neil Boyette

Once a client company and a service provider sign a high deal spanning many years, the client creates a large number of small TCV short term deals. These deals are short term and the service provider must quickly react. Often, deal managers are not able to react fast because there are multiple organizations working on the deal. This paper describes a system built to assist managers when making daily decisions by exposing the current status of a deal though data aggregation and analysis.

2 - Multiple QoS in Service Composition

Soundar Kumara, Pearce Professor of Industrial Engineering, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, u1o@engr.psu.edu, LiYing Cui

A service network is a graph consisting of services and semantic concepts. Service composition is to form a compound workflow of services so that this compound workflow can execute complex tasks which cannot be done by an individual service. This research deals with multiple criteria of QoS (quality of services) in service composition. It compares six different scenarios.

3 - On Quantitative Estimate of Service Pilot Parameters

Genady Ya Grabarnik, St. John's University, Queens, NY, United States of America, grabarng@stjohns.edu, Laura Shwartz, Yefim Haim Michlin

Before we showed robustness of the pilot test and service process parameters for the processes with large team of servers (SA). This paper gives quantitative estimate of the service process parameters and tests OC, ASN for teams of any size. 1. Michlin, Y. H., Grabarnik, G., Search boundaries of truncated discrete sequential test, J. App. Stat., (37)5, 2010,707-724. 2. Grabarnik,G.Ya., Michlin,Y.H., Shwartz,L. Designing Pilot for Operational Innovation in IT Service Delivery, BDIM 2012.

■ MB39

39- North 226 C- CC

Applications in the Service Industry

Contributed Session

Chair: Sahar Talebi, PhD Student, North Carolina State University, Raleigh, NC, 27606, United States of America, stalebi@ncsu.edu

1 - Optimizing a Cloud-based Service Design using Social Media

Amir Zadeh, Oklahoma State University, 101 Hanner Hall Stillwater Campus, Stillwater, 74075, United States of America, amir.zadeh@okstate.edu, Ramesh Sharda

Today, service providers offer a number of computing services on clouds and each of these services has different characteristics as regards price, security, compliance and competition, quality issues. On the other hand, individual and social influences play an important role in a consumer's service choice. In this paper, a cloud-based service design problem affected by peer influence is developed to optimize the service provider's profit and to incorporate social interactions.

2 - Services in Manufacturing Companies – From the Backyard to the Forefront

Thomas Meiren, Fraunhofer IAO, Nobelstr. 12, Stuttgart, Germany, thomas.meiren@gmx.de, Ilyas Khan

Product-related services play an increasing role in manufacturing companies. The presentation discusses how these firms describe and structure their service portfolios and communicate them to customers. Moreover, it includes the results of an empirical study among 100 manufacturing companies.

3 - Developing the Optimization Program for Assigning the Field Service Person in the Gas Utility

Hiroshi Kashio, Tokyo Gas Co., Ltd., 1-5-20 Kaigan Minato, Tokyo, Japan, kashio@tokyo-gas.co.jp, Shinnosuke Kimura

Tokyo Gas opens and closes about 2.5 million gas meters and repairs more than 5 million gas appliances annually. The local service centers assign their field service person to these jobs by hand every day. We developed the auto-assignment program for minimizing their travelling distances and the rate of missing the appointed time. And we trialed it at a center and confirmed its effect quantitatively.

4 - An ILP Formulation for RWA in Elastic Optical Networking

Sahar Talebi, PhD Student, North Carolina State University, Raleigh, NC, 27606, United States of America, stalebi@ncsu.edu

Service providers are using higher bit rates, like 40 Gb/s and 100 Gb/s per wavelength. However, it is likely that bit rates greater than 100 Gb/s will not fit into this scheme. Besides, the 10-year-old division of the optical spectrum of fixed "wavelength grid" will no longer work for 400 Gb/s and above. We tried to develop a new ILP formulation for routing and wavelength assignment (RWA) while we also consider the flexibility of the gird in this formulation.

■ MB40

40- North 227 A- CC

Empirical Research in Environmental Operations

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Brian Jacobs, Assistant Professor, Michigan State University, 632 Bogue St. Rm N370, East Lansing, MI, 48824, United States of America, jacobsb@bus.msu.edu

1 - Environmental Certification and its Impact on Supply Chain Members: An Event Study

Myung Kyo Kim, Doctoral Candidate, Michigan State University, North Business College Complex, 632 Bogue St. Rm N461, East Lansing, MI, 48824, United States of America, myungkyo@bus.msu.edu, Tobias Schoenherr, Brian Jacobs, Ram Narasimhan

Increasingly, firms are utilizing external accreditation agencies to document environmental initiatives to consumers. While ISO 14000 certification has been relatively widespread, one certification on the rise is the certification offered by the Forest Stewardship Council (FSC), guaranteeing a credible link between responsible production and consumption of wood products. The present research focuses on this FSC certification and investigates its financial impact for adopting firms.

2 - Customer Satisfaction with New and Remanufactured Products

Ravi Subramanian, Associate Professor, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Ravi.Subramanian@mgt.gatech.edu, Ramanath Subramanyam

Customer satisfaction with remanufactured products relative to their new counterparts is of key concern to OEMs and Third Parties offering them. Using field data, we compare customer satisfaction levels for remanufactured and new products.

3 - Relationship between Appointments of Sustainability Officers and Performance

Manpreet Hora, Assistant Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St. NW, Atlanta, GA, 30332, United States of America, Manpreet.Hora@mgt.gatech.edu, Ravi Subramanian

In recent years, firms have been creating and staffing senior-level environmental and sustainability positions. We investigate the association between announcements pertaining to appointments of senior-level environmental or sustainability officers and firm performance.

4 - Persistence of Sustainability Capabilities: An Empirical Analysis

Brian Jacobs, Assistant Professor, Michigan State University, 632 Bogue St. Rm N370, East Lansing, MI, 48824, United States of America, jacobsb@bus.msu.edu, Sriram Narayanan

In this study, we examine the persistence of sustainability capabilities and draw implications for how sustainability capabilities of firms change over time. We examine how the "ecosystem" of internal capabilities and those of industry counterparts influence the persistence of firms' sustainability capabilities.

■ MB41

41- North 227 B- CC

Joint Session ENRE-Env & Sustainability/Energy: Biofuel Production and Supply Chain Management

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability & Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Guiping Hu, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu

1 - A Mixed Integer Programming Model and Analysis of Biofuel Production

Halil Ibrahim Cobuloglu, Graduate Research Assistant, Wichita State University, 1845 N Fairmount, Office 208A, Ind. & Manuf. Engineering Department, Wichita, KS, 67260, United States of America, hicobuloglu@wichita.edu, Esra Buyuktahtakin

In this study, we propose a multi-objective mixed integer programming model for biofuel production using switchgrass in US. This mathematical model maximizes the yield from switchgrass during its expected life span while considering its potential economical and environmental impacts under various production and harvesting scenarios.

2 - Biomass/Biofuel Logistics Network Design

Gokhan Memisoglu, PhD Student, Texas A&M University, Industrial and Systems Engineering Department, Emerging Technologies Building 3131 TAMU, College Station, TX, 77843-3131, United States of America, gmemis@tamu.edu, Halit Uster

This research is about logistic and supply chain of biomass and biofuel. We constructed the supply chain for biofuel starting from farms and to the blending facilities where the biofuel is blended with the regular fuel. In our model we assumed that demand and supply are known and deterministic. Our objective is to determine the location of the collection facilities and biorefineries to be opened and also to determine the production, inventory and logistic (transportation) decisions.

3 - Contracting for Cellulosic Biomass: Effects of Contract Structure and Yield Variability on Supply

Adaora Okwo, Georgia Institute of Technology, Atlanta, GA, United States of America, aokwo@gatech.edu

We model land allocation to perennial energy crop production and estimate the cellulosic biomass supply under different contract payment options. Biomass supply under each option varies according to the quality of land used to grow the biomass. Using switchgrass production in Tennessee as a case study, we show that pay-per-unit biomass contracts are more effective for premium lands and short-term contracts while pay-per-acre contracts are more effective for marginal lands and longer terms.

4 - Optimization Models for Biofuel Supply Chain under Uncertainty

Guiping Hu, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu, Narges Kazemzadeh

This study aims to determine the optimal design of biofuel supply chain to maximize annual profit considering uncertainty in feedstock yield, fuel market price and logistic costs. To deal with the stochastic nature of parameters, we develop two-stage stochastic programming models in which Conditional Value at Risk is considered as a risk measure to control shortage of demand. A case study in the state of Iowa is conducted to demonstrate the applicability and efficiency of the models.

■ MB42

42- North 227 C- CC

Transportation Networks and Plug-in Electric Vehicles I

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Chi Xie, Research Associate, The University of Texas at Austin, 1616 Guadalupe St, UTA 4.403, Austin, TX, 78701, United States of America, chi.xie@mail.utexas.edu

1 - Plug-in Electric Vehicular Flows in Equilibrium Networks

Chi Xie, Research Associate, The University of Texas at Austin, 1616 Guadalupe St., UTA 4.403, Austin, TX, 78701, United States of America, chi.xie@mail.utexas.edu

This presentation discusses a set of new network equilibrium models and methods that incorporate alternative travel restrictions and cost compositions of battery electric vehicles and plug-in hybrid electric vehicles into the traditional urban transportation network modeling paradigm.

2 - Locating Replenishment Stations for Electric Vehicles: Application to Danish Traffic Data

Oli Madsen, Professor, Technical University of Denmark, DTU Transport Bygningstorvet 115, Kgs. Lyngby, 2800, Denmark, ogm@transport.dtu.dk, Anders Norrelund, Min Wen, Allan Olsen, Gilbert Laporte

This paper considers the problem of locating electronic replenishment stations for electric vehicles on a traffic network with flow-based demand. The objective is to optimize the network performance, e.g. to maximize the flow covered by a prefixed number of stations, or to minimize the number of stations needed to cover traffic flows. Two mixed integer linear programming formulations are proposed to model the problem. These models are tested on real-life traffic data collected in Denmark.

3 - Stochastic Network Equilibrium of PEVs: Impacts of Electricity-charging Price and Speed

Ti Zhang, University of Texas-Austin, Austin, TX, United States of America, tizhang@utexas.edu, Chi Xie, Travis Waller

The purpose of the research is to develop a stochastic network equilibrium model that can take into account for (i) charging cost and (ii) the charging time for BEV drivers. This research result contains initiative insights of an equilibrium route choice model for BEV motorists impacted by the charging price and speed. Two logit-based stochastic traffic assignment models are built to study the route choice behavior of BEV drivers in a network and a solution algorithm is proposed.

■ MB43

43- North 228 A- CC

Railway Models under Uncertainties

Sponsor: Railway Applications

Sponsored Session

Chair: Rapik Saat, Research Assistant Professor, University of Illinois at Urbana-Champaign, 205 N Mathews, Urbana, IL, 61801, United States of America, mohdsaat@illinois.edu

1 - Railroad Hazardous Materials Transportation Risk Analysis under Uncertainty

Xiang Liu, University of Illinois at Urbana-Champaign, liu94@illinois.edu, Christopher Barkan, Rapik Saat

There are various sources of input uncertainty in the risk analysis of hazardous materials transportation by rail. In this research, we develop a stochastic model to quantify the effect of parameter uncertainty in the risk analysis. The statistical distribution of risk estimates is developed using probabilistic models and Monte Carlo simulation methods.

2 - Terminal Health and Solution Path

Brian Blevins, Sr Manager Service Design, BNSF, 2600 Lou Menk Dr., Fort Worth, TX, 76131, United States of America, Brian.Blevins@BNSF.com

Railroads are constantly struggled to identify where they are experiencing problems on their network. In an attempt to improve design efficiency I created a Terminal Health System that analyzes 3 dwell measurements and compares the current performance to historic percentiles. The struggling terminal is put on a list and emailed to our design staff on a daily basis. While this system is very basic, we have been able to track its ability to find issues and offer solutions.

3 - A Framework for Track Geometry Defect Risk Prediction and Maintenance Schedule Optimization

Qing He, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, qhe@us.ibm.com, Dhaivat Parikh, Debarun Bhattacharjya, Arun Hampapur, Hongfei Li

Track geometry defects, including align, gage, cant, surface, crosslevel, warp and so on, can be categorized as red and yellow tickets by severity. Red tickets are mandatory to be fixed by law but not yellow tickets. We proposed a risk model to prioritize yellow tickets by estimating its derailment risk. Given the inputs from risk model and other constraints, a repair schedule optimization model was developed to further reduce total cost on potential derailment and maintenance.

4 - Train Dispatching Model with Stochastic Capacity Breakdowns on an N-tracked Rail Network

Lingyun Meng, School of Traffic and Transportation, 8507D, No.8 Teaching Building, No.3 ShangYuanCun, HaiDian District, China, lymeng@bjtu.edu.cn, Xuesong Zhou

This paper presents an integer programming formulation for the networked train dispatching problem. A Lagrangian relaxation solution approach is used to dualize complicating capacity constraints and decompose the original complex problem into a sequence of sub problems. The sub problems are solved by a shortest path algorithm. A priority rule-based algorithm is used to deduce dual solutions to feasible solutions. Numerical experiments are used to demonstrate the performance of this approach.

■ MB44

44- North 228 B- CC

Supply Chain: Issues in Green Supply Chain Management

Contributed Session

Chair: Karca Aral, PhD Student, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, karca.aral@insead.edu

1 - Sustainability Efforts in Supply Networks

Alvaro Mendoza, PhD Student, Duke University, The Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, alvaro.mendoza@duke.edu, Robert Clemen

We consider brand buyers competing on the sustainability performance of their supply chains. Only suppliers are able to exert sustainability efforts, while buyers can provide economic and technical support to their suppliers. We study the impact of various characteristics of buyers, suppliers, and stakeholders on the effort and support decisions under two different structures of the supply network: one where buyers share suppliers and the other where buyers have separate suppliers.

2 - Sustainable Supply Chain Network Design

Ali HajiAghaBozorgi, University of Central Florida, 4136 Guadalupe Ct, Orlando, Fl, 32817, United States of America, alililihozak@yahoo.com, Jennifer Pazour, Dima Nazzal

We study multi-objective inventory control for perishable items considering economic and environmental objectives. We will present our results to date on analyzing the structure of the economic inventory holding and transportation cost and the environmental impacts, which will guide our inventory control policies.

3 - Strategic Management of Remanufacturing in Closed-loop Supply Chains

Sung Hoon Chung, Visiting Assistant Professor, The College of William and Mary, P.O. Box 8795, Williamsburg, VA, United States of America, sxc447@gmail.com, Robert Weaver, Terry Friesz

We consider a sustainable remanufacturing model of firms embedded in a dynamic supply chain. The profitability of remanufacturing has been extensively studied. The environmental aspects of remanufacturing has also been widely investigated. The models that consider both perspectives are much rare due to complexity. We propose a differential variational inequality framework that enables us to tackle two such important aspects simultaneously while maintaining computational tractability.

4 - The Implications of Carbon Management on Supply Chain Design Issues

Yi-Fen Chen, University of California-Berkeley, 1115 Etcheverry Hall, Berkeley, CA, 94720, United States of America, yifenchen@berkeley.edu, Z. Max Shen, David Dornfeld

Companies normally focus on transportation tactics to reduce carbon emissions of their supply chains. However, this may lead to suboptimal decisions due to the lack of considerations of other supply chain activities, such as warehouse operations. An integrated supply chain design model was constructed to investigate the trade-offs between warehouse and transportation carbon emissions. We also investigate an multi-objective problem that minimizes both cost and carbon emissions.

5 - Optimal Supplier Retention Policies under Sustainability Default Risk

Karca Aral, PhD Student, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, karca.aral@insead.edu, Luk Van Wassenhove

For large multinationals, environmental and social risks associated with its suppliers are critical issues. The complexity of regulations, as well as rapidly evolving environmental and social standards, makes responsible procurement a very important part of Corporate Social Responsibility agendas. In this study, we present an analytical model for responsible procurement for a firm facing green demand, and discuss optimal interaction and retention policies regarding its suppliers.

■ MB45

45- North 229 A- CC

Panel Discussion: Academic Job Search

Cluster: Job Placement Services

Invited Session

Chair: Bala Shetty, Professor, Texas A&M University, College Station, TX, United States of America, b-shetty@tamu.edu

1 - Panel Academic Search

Moderator: Bala Shetty, Professor, Texas A&M University, College Station, TX, United States of America, b-shetty@tamu.edu, Panelists: Neil Geismar, Eva Lee

The panel will discuss the academic interview process and do's and don'ts associated with the job search. In addition to comments by current and former search chairs, time will be provided for questions and answers.

■ MB46

46- North 229 B- CC

Joint Session Amazon/CPMS: Amazon- Operations Research Decisions are Implemented in Practice

Cluster: Amazon & CPMS, The Practice Section

Invited Session

Chair: Stephen Graves, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, sgraves@mit.edu

1 - Making Better Replenishment Decisions in Online Retail

Jason Acimovic, Assistant Professor, Pennsylvania State Smeal College of Business, 5 Carlisle St., Unit 3, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Stephen Graves

Online retailers operate multiple warehouses with centralized order fulfillment and inventory management. When an individual warehouse stocks out, demand spills over to another warehouse. We show the pitfalls of the local base-stock policy – popular in practice. This kind of replenishment policy can lead to undesirable dynamics and high outbound shipping costs. We show evidence on data from a large online retailer. We propose a new replenishment policy that performs better.

■ MB47

47- North 230- CC

Traffic Modeling using Mobile Sensors

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: David Kim, Associate Professor, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu

1 - Utilizing Wireless Roadside Sensors as Vehicle Point Detectors

David Kim, Associate Professor, Oregon State University, 204 Rogers Hall, Corvallis, OR, 97331, United States of America, david.kim@orst.edu, SeJoon Park, Amirali Saeedu, David Porter

This research examines additional data collection capabilities of wireless roadside sensors for transportation applications. Experience with Bluetooth wireless roadside sensors show that enabled devices are typically detected multiple times as a vehicle moves through the sensor antenna coverage area, which may extend 200 to 300 yards from the roadside sensor. In this research signal strength data from Bluetooth devices is obtained at the same time that the enabled devices are detected. The signal strength data is used to identify when the vehicle is close to passing the sensor. Tests in both controlled and real world environments show the resulting accuracy is sufficient to extend the use of wireless technology to other transportation data collection applications.

2 - Vehicle Classification using Mobile Sensors

Zhanbo Sun, Rensselaer Polytechnic Institute, 2162, 14th Street, 2nd Floor, Troy, NY, 12180, United States of America, sunz2@rpi.edu, Jeff Ban

We consider staffing agents in which an initial forecast of the call volume is given at the beginning of the day. After an initial observation period, the manager has the ability to update the staffing level based on a revised forecast. The manager operates under QoS constraints which can be very general. The resulting problem is formulated as a two-stage stochastic program. When utilization is the metric, the resulting solution can be written in a closed form analogous to a newsvendor solution.

3 - Estimation of Long Queues using Mobile Sensors for Traffic Signals

Peng Hao, Rensselaer Polytechnic Institute, 108 8th Street, Troy, NY, 12180, United States of America, haop@rpi.edu, Jeff Ban

We develop methods to estimate queue lengths of signalized intersections using mobile data when the queue exceeds the upstream data collection location. The proposed method is based on LWR theory which is reformulated for this particular scenario.

4 - Mesoscopic Traffic State Estimation using GPS and Bluetooth Data

Hao Lei, Phd Student, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, hao.lei@utah.edu, Xuesong Zhou, Wen Deng

This talk discusses how to use multiple data sources, including loop detector counts, AVI Bluetooth travel time readings and GPS location samples, to estimate mesoscropic traffic states on a homogeneous freeway segment. We extend Newell's three-detector method to approximate stochastic cumulative flow counts, by using a multinomial probit model and Clark's approximation method.

■ MB48

48- North 231 A- CC

VRP and Applications I

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Johan Oppen, Associate Professor, Högskolen i Molde, Britvegen 2, Molde, 6410, Norway, johan.oppen@himolde.no

1 - Toll Enforcement Planning by Integer Programming

Elmar Swarat, Konrad-Zuse-Zentrum für Informationstechnik Berlin, Berlin, Germany, swarat@zib.de

We present an Integer Programming model for an optimization of toll enforcements on German motorways. The goal is to find a set of vehicle tours over the entire motorway network. They are planned according to spatial and temporal traffic distributions. In addition, a duty roster plan is generated for each crew member that is assigned to the tours. We will show that many practical requirements can be modeled. Computational results demonstrate that real-world instances can be solved.

2 - Snow Control and Winter Maintenance Scheduling

Leila Hajibabai, University of Illinois at Urbana-Champaign, 205 N Mathews Avenue, Room 3142, Urbana, IL, 61801, United States of America, leila.hajibabai@gmail.com, Seyed Mohammad Nourbakhsh, Yanfeng Ouyang

Snow control is a key component of winter maintenance for many urban/regional agencies, especially in case of heavy snowfall. In this paper, a mixed integer linear program (MILP) was proposed to simultaneously minimize total travel time of snowplow trucks and their longest individual cycle time. To solve this problem, a set of meta-heuristic methods were developed and applied to an empirical case study with realistic data.

3 - Scheduling and Transportation in the Construction Industry

Johan Oppen, Associate Professor, H gskolen i Molde, Britvegen 2, Molde, 6410, Norway, johan.oppen@himolde.no, Anastasia Rubasheuskaya

We present a real-world planning problem faced by many companies in the construction industry. Given a number of jobs or projects, where each job has a known location, estimated duration and demand of materials, the problem is to assign projects to teams of workers, schedule the projects for each team, and construct a transportation plan for how to supply the projects with the needed materials. We use asphalt spreading as an example, and show that the problem can be modelled as a combined scheduling and routing problem. Possible solution approaches are discussed.

4 - A Vessel Routing Problem with Time Windows for Steel-raw Materials Delivery

Byung-In Kim, POSTECH, San 31, Hyoja, Namgu, Pohang, 790-784, Korea, Republic of, bkim@postech.ac.kr, Juyoung Wy, Jongsung Lee

This research considers a vessel routing problem with time windows, in which loads can be split or can be combined and be loaded into ships, and the ships can visit multiple ports to load or unload materials in each trip. We want to find routes of a fleet of ships which provide smooth supply of raw materials with less cost. A mathematical model and a large neighborhood search algorithm are developed for the problem. Computational experiments demonstrate the effectiveness of the proposed algorithm.

5 - Two Commodities Pickup and Delivery Heuristic to Solve the Containership Routing Problem with Time Windows

Satish Ukkusuri, Associate Professor, Purdue University, 550 Stadium Mall Drive, G175F, West Lafayette, IN, 47906, United States of America, sukkusur@purdue.edu, Binh Luong, Rodrigo Mesa-Arango, Matthew Karlaftis

This paper considers the containership routing problem for pickups and deliveries of products between a hub and a set of ports. The products are perishable and they need to be collected and delivered in specific time windows. A heuristic approach is proposed and tested using data from a real world ship routing problem. The numerical results demonstrate a good approximation to the optimal solution with considerable computational savings.

■ MB49

49- North 231 B- CC

Transportation Infrastructure Management II

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu

1 - Bus Fleet Replacement Optimization Framework with Real World Fleet Data

Miguel Figliozzi, Associate Professor, Portland State University, P.O. Box 751 CEE, OR 97207-075, Portland, OR, United States of America, figliozzi@pdx.edu, Wei Feng

We present a bus fleet replacement optimization framework that incorporates real-world bus fleet utilization, fuel economy, maintenance cost data and optimization models. Both an integer programming model and a stochastic dynamic programming model are formulated to provide optimal fleet replacement decisions under heterogeneous and homogeneous fleet assumptions.

2 - Equipment Replacement Optimization: Algorithms, Implementations, and Numerical Results

Wei Fan, Associate Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd, Tyler, TX, 75799, United States of America, wfan@uttyler.edu, Randy Machemehl, Mason Gemar

The primary function of equipment managers is to replace the right equipment at the right time and at the lowest overall cost. First, both deterministic and stochastic dynamic programing models are formulated for the equipment replacement optimization (ERO) problem. Second, both Bellman's and wagner's approaches are developed to solving the ERO. Finally, the implementation techniques are presented. Comprehensive ERO numerical results are also discussed.

3 - The Design and Optimization of Modules in Total Efficiency Maintenance Mode for Urban Mass Transit

Yongneng Xu, The Design and Optimization of Modules in Total Efficiency Maintenance Mode for Urban Mass Transit, Department of Transportation Engineering at Nanjing University of Science & Technology, 200 Xiaolingwei Street, Nanjing, JS, 210094, China, x780906yn@163.com, Yu Zhang

To alleviate the imbalance between traffic demand and capacity in Nanjing Metro, we propose Total Efficiency Maintenance Mode (TEM). The objective of the proposed mode is to improve the productivity of maintenance crew and utilization of rolling stocks while ensuring the reliability of core components of rolling stocks. This presentation presents the methodology of rearranging maintenance modules and optimizing the combination of base and variable modules in proposed mode.

4 - Accounting for Equity in Infrastructure Maintenance

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu

Equity issues often arise in budget allocation, whether between rural and urban areas, or among specific districts or regions. Simply allocating projects in a geographically diverse area may not be enough, because the equity issue is based on the users who benefit, not the infrastructure itself. This presentation introduces several methods for incorporating equity constraints or metrics into maintenance optimization formulations, and provides initial discussion of their merits and limitations.

■ MB50

50- North 231 C- CC

Military Vehicle Routing II

Sponsor: Military Applications

Sponsored Session

Chair: Chase Murray, Assistant Professor, Industrial & Systems Engineering, Auburn University, Auburn, AL, United States of America, ccm0022@auburn.edu

1 - Multi-perspective Optimization of Unmanned Vehicles Routes for Information Gain

Hector Ortiz-Pena, CUBRC Inc., 4455 Genesee St., Buffalo, NY, 14225, United States of America, Hector.Ortiz-Pena@cubrc.org, Mark Karwan, Moises Sudit

We develop a mixed integer linear program to maximize the information gain from a team of autonomous unmanned vehicles (UxVs).Vehicles are operating in a decentralized framework. The mathematical formulation considers each UxV's perspective of the environment and mission, as information is only exchanged when UxVs are part of the same communication network. Area of operation is represented by a set of grid cells; each cell characterized by a value representing the potential information gain.

2 - UAV Path Selection Metric using the Particle Filter Framework in an Urban Environment

Emily Doucette, Air Force Research Laboratory, 101 W. Eglin Blvd., Eglin AFB, FL, United States of America, douceea@tigermail.auburn.edu

A constant velocity UAV is to intercept a target ground vehicle of unknown position, velocity, and destination within an urban setting. A particle filter with a traffic motion model is used to represent the target state. Binary measurements of subsections of the urban environment are corrupted by false reports. Particle weight along a path is used as a novel path selection metric and is compared to an existing entropy reduction metric by means of intercept and computation time.

3 - Dynamic Decentralized Cooperative Control for UAVs

Michael Hirsch, Raytheon Company, Orlando, FL, United States of America, mjh8787@ufl.edu, Daniel Schroeder

In this research, we discuss recent results related to dynamic decentralized cooperative control for autonomous unmanned vehicles. The vehicles operate in an urban domain, and are tasked with searching and tracking targets of interest. We also highlight some new metrics for analyzing our results.

■ MB51

51- North 232 A- CC

DIME/PMESII Modeling I

Sponsor: Military Applications

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - DEXES-II: An Alternative to Agent-Based Spatial Modeling of Societal Response

Loren Cobb, Associate Research Professor, University of Colorado Denver, Dept. of Mathematics, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, cobb@Aetheling.com

DEXES-II is a simulation model developed for large-scale civil-military exercises in peacekeeping, disaster relief, and complex humanitarian emergencies. Since 1994, DEXES models have employed spatially-distributed variables for social, economic, political, and health conditions, including refugee dynamics, public opinion, ethnic conflict, and pandemic disease. Unlike DEXES-I, the current DEXES-II version is completely free of agents. The DEXES model approach and its pros and cons are discussed.

2 - Validating DEXES-II

Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

The Deployable Exercise System II (DEXES-II) is a new social model being developed by Dr. Loren Cobb for USSOUTHCOM. I describe the validation of the DEXES-II conceptual model with The DIME/PMESII VV&A Tool, which uses the Total Irregular warfare Ontology as the basis for linking the model to the social theories supporting the model. I describe both the process and the results.

3 - Optimizing Counterinsurgency Operations

Marvin King, Major, USA, United States Army, Student Detachment, Fort Jackson, SC, 29207, United States of America, marvin.king1@us.army.mil, Alexandra Newman, Amanda Hering

We present a model that uses historic casualty information on counterinsurgents and insurgents, allied military force strengths, and economic data with modern counterinsurgency theories to aid in the estimate of force requirements for ongoing and future counterinsurgency campaigns. Our mathematical optimization model provides insights that allow the military and government to make more informed decisions regarding the number of forces to deploy in future conflicts.

■ MB52

52- North 232 B- CC

Modeling Energy Markets

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Steven Gabriel, University of Maryland, College Park, MD, United States of America, sgabriel@umd.edu

1 - Equilibrium Prices from MIPs: Applications to Unit Commitment and Electric Capacity Expansion

David Fuller, Professor, University of Waterloo, Department of Management Sciences, Waterloo, N2L 3G1, Canada, dfuller@uwaterloo.ca

Market equilibrium models with continuous and binary variables may have no solution if prices are only for continuous variable commodities. O'Neill et al. proposed prices for continuous commodities and binary variables, but their proposal has shortcomings: the possibility that some prices are negative; possibly unfair price discrimination; and an incomplete treatment of the fact that all revenues paid to producers must be collected from consumers. Resolutions of these shortcomings are discussed.

2 - A Decomposition Method for Solving Equilibrium Programs with Equilibrium Constraints

Sauleh Siddiqui, Assistant Professor, Johns Hopkins University, 2122 Massachusetts Ave., NW, Apt 208, Washington, DC, 20008, United States of America, sauleh.siddiqui@gmail.com, Steven Gabriel

Equilibrium Programs with Equilibrium Constraints (EPECs) are a type of two-level optimization problem that are computationally expensive to solve. In this talk, we provide a solution technique based on decomposition to tackle this class of problems. Theoretical support of our method will be provided as well as an application to the US Natural Gas market.

3 - A Stochastic Optimization Model with Varying Objectives for Renewable Energy Investment at AWTP

Chalida U-tapao, PhD Candidate, University of Maryland, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, cutapao@umd.edu, Steven Gabriel

We present a stochastic optimization model with varying objectives for an advanced wastewater treatment plant (AWTP) that considers renewable energy investment and operational decisions under uncertainty. Examples of the uncertainty include: natural gas and electric power prices and carbon dioxide credits. These decisions involve converting uncertain amounts of biosolids into biogas and/or electricity for internal or external purposes. We also consider investment other clean energy sources.

4 - The Impact of Carbon Costs on the Global Natural Gas Market

Hakob Avetisyan, PhD Candidate, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, havetisy@umd.edu, Steven Gabriel

World Gas Model (WGM) developed in the University of Maryland is expanded to capture the effects of carbon costs on the natural gas market prices, production/consumption levels and export volumes from the U.S. The impact on the market is analyzed for cases where carbon costs are imposed on: suppliers, consumers, suppliers and consumers. The game theoretic structure of WGM allows for detailed analyses of carbon cost effects on the natural gas market in contrast to economic intuition.

■ MB53

53- North 232 C- CC

Optimization Models for Smart Grids

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Lawrence V. Snyder, Associate Professor, Lehigh University, 200 West Packer Ave., Mohler Lab, Department of Industrial and Systems Engr, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu

1 - Integrating Short-term Unit Commitment Constraints into Transmission Planning

Saamrat Kasina, Student, Johns Hopkins University, 3400 North Charles Street, Ames Hall 319, Baltimore, MD, 21218, United States of America, k.saamrat@gmail.com, Francisco Munoz, Benjamin Hobbs

Transmission planning studies for renewable integration usually apply heuristic methods to decide which transmission lines to build, but optimization has been proposed. We ask whether operational constraints such as plant ramp-rates, zonal reserve requirements, and start-up decisions would significantly affect investments chosen by a two-stage stochastic transmission optimal expansion model. The value of integrating these features (in terms of improved expected performance) is also estimated.

2 - Electricity Market Operations

Alberto Lamadrid, Graduate Student, Cornell University, 419 Warren Hall, Ithaca, NY, 14850, United States of America, ajl259@cornell.edu, Tim Mount, Ray Zimmerman, Robert Thomas, Carlos Murillo

This paper analyzes the effect of the initial conditions for a stochastic program combining unit-commitment and AC optimal power flow problem for an electricity system with high penetration of renewable energy sources. The uncertainty sources are divided by their ontological characteristics, as bounds on the knowledge of the state of nature, and as low probability events. The modeling of Energy Storage Systems (ESS) and deferrable demand is explicitly included in a secure (n - 1) framework.

3 - A Bilevel Model for Retail Electricity Pricing with Flexible Loads

Lin He, PhD Candidate, Lehigh University, H.S. Mohler Laboratory, 200 West Packer Ave., Bethlehem, PA, 18015, United States of America, lih308@Lehigh.EDU, Larry Snyder

We consider an electricity service provider that wishes to set prices for a large customer with flexible loads so that the resulting load profile matches a predetermined profile as closely as possible. Assuming the customer minimizes its electricity and delay costs, we model this as a bilevel problem in which the provider sets prices and the customer responds by shifting loads forward in time. We derive optimality conditions for the lower-level problem to obtain a single-level problem.

4 - A Roadmap for Formulating a Generation Expansion Planning Model to Minimize Healthcare Costs

Mark Rodgers, PhD Student/Graduate Fellow, Rutgers University, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States of America, mdrodgers07@gmail.com, Frank Felder, Saltuk Selcuklu, David Coit

The framework for formulating a long-term power generation expansion planning model to minimize healthcare costs is described. We extend the typical least-cost GEP algorithm to consider societal healthcare costs incurred due to unfavorable implications resulting from power plant emissions. Methods of quantifying these costs will be evaluated, and a mathematical framework for this particular GEP model will be presented. Various surrogate based optimization techniques will also be assessed.

■ MB55

55- Regency Ballroom B - Hyatt

Joint Session OR in Emerging Econ/ENRE-Energy: OR Applications in the Energy Sector of Emerging Markets

Cluster: Operations Research in Emerging Economies & Energy, Natural Res & the Environment/Energy

Invited Session

Chair: Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, São Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br

1 - Planning Investments and Operation of a Natural Gas Network under Uncertainty

Leonardo A.M. Moraes, Operations Research Analyst, PETROBRAS, Av Nilo Pecanha, 151, 7 andar-Centro, Rio de Janeiro, RJ, 20020-100, Brazil, leonardo.moraes@petrobras.com.br, Julien P.C.B. Jonqua, Larissa F.T.F. Reis, Carolina C.L.B. Vielmond

This work considers the problem of planning investments and operation of a Natural Gas (NG) network for a horizon of twenty years. NG market comprises several usages of this commodity, as energy generation and supplying contracts. Moreover, in an integrated company, all activities are interconnected, from gas extraction to its distribution and decision must take into account uncertainties on the demand level and gas prices. We model and solve this problem as a two-stage stochastic program.

2 - Evaluation of Choices for Rural Electrification in Emerging Economies: A Multi-criteria Approach

Md Mizanur Rahman, Researcher, Aalto University School of Engineering, Department of Energy Technology, Otakaari 4, Espoo, FI-02150, Finland, mdmizanur.rahman@aalto.fi, Jukka Paatero

Making decisions concerning rural electrification is rather complex and it is limited by economic and technical constraints, socio-cultural dynamics, and environmental consequences. Here a multi-criteria approach that utilizes a stochastic multi-criteria acceptability analysis tool is presented to support decision makers concerning the extension of electricity services to rural areas.

■ MB56

56- Curtis A- Hyatt

Joint Session TMS/NPD/ORG SCI: Meet the Editors and Ask Them Questions

Sponsor: Technology Management, New Product Development & Organization Science

Sponsored Session

Chair: Leonardo Santiago, Federal University of Minas Gerais, Escola de Engenharia da UFMG, Av. Antonio Carlos, 6627. Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br

1 - Panel Discussion: Meet the Editors and Ask Them Questions

Moderator: Leonardo Santiago, Federal University of Minas Gerais, Escola de Engenharia da UFMG, Av. Antonio Carlos, 6627. Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Panelist: Andreas Schwab

Meet the Editors and Departmental Editors of Technology, Innovation and Entrepreneurship Journals and ask them questions.

■ MB57

57- Curtis B- Hyatt

Stochastic Optimization

Sponsor: Applied Probability

Sponsored Session

Chair: Bo Zhang, Research Staff Member, IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, zhangbo@us.ibm.com

1 - Online Stochastic Bin Packing

Varun Gupta, Booth School of Business, University of Chicago, Chicago, IL, 60637, United States of America, varun.gupta@chicagobooth.edu, Ana Radovanovic

In one-dimensional online stochastic bin packing, n items with sizes sampled i.i.d. from an unknown distribution arrive as a stream and must be packed on arrival to minimize the number of non-empty bins. We present the first truly distribution-agnostic bin packing heuristic that achieves additive O(sqrt(n)) waste compared to OPT for all discrete distributions. We also present some preliminary results on stochastic online bin packing with item departures.

2 - Stochastic Sequential Assignment Problem with Threshold Criteria

Golshid Baharian, University of Illinois, Urbana, IL, United States of America, gbahari2@illinois.edu, Sheldon Jacobson

A class of problems is presented where available distinct resources are allocated to sequentially arriving tasks with stochastic parameters so as to minimize the probability of the total reward failing to achieve a target value. Sufficient conditions for the existence of a deterministic Markov optimal policy are derived. Moreover, an algorithm to approximate the optimal value function and the optimal policy is presented, and convergence results are established.

3 - Near-optimal Online Algorithms for Dynamic Resource Allocations

Xin Lu, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, luxin@mit.edu, Patrick Jaillet

In this paper, we study a general online linear programming problem whose formulation encompasses many dynamic resource allocation problems. We propose a stochastic model, which under mild assumptions, allow near-optimal learning-based online algorithms without prior knowledge on the total number of requests to come, a first of its kind.

4 - Optimal Production Management when Demand Depends on the Business Cycle

Abel Cadenillas, University of Alberta, Edmonton, AB, Canada, acadenil@math.ualberta.ca, Michael Pinedo, Peter Lakner

We assume that consumer demand for an item follows a Brownian motion with drift that is modulated by a continuous-time Markov chain that represents the regime of the economy. The economy may be in either one of two regimes. Management of the company would like to maintain the inventory level of the item as close as possible to a target inventory level and would also like to produce the items at a rate that is as close as possible to a target production rate. The company is penalized by the deviations from the target levels and the objective is to minimize the total discounted penalty costs over the long term. We consider two models. In the first model the management of the company observes the regime of the economy at all times, whereas in the second model the management does not observe the regime of the economy. We solve both problems and obtain the optimal production policy as well as the minimal total expected discounted cost. We also study the case in which the consumer demand for an item follows a geometric Brownian motion modulated by a continuous-time Markov chain that represents the regime of the economy.

■ MB58

58- Phoenix East- Hyatt

Statistical Learning Methods and Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Mohsen Bayati, Stanford University, Stanford, CA, United States of America, bayati@stanford.edu

1 - Ordered Rules for Classification

Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Allison Chang, Dimitris Bertsimas

We aim to design classifiers that have the interpretability of association rules yet match the predictive power of top machine learning algorithms. We propose a novel mixed integer optimization (MIO) approach for this task. Our algorithm builds decision list classifiers that are both simple and insightful.

2 - Mining Medical Discussion Board Data

Shawndra Hill, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19103, United States of America, shawndra@wharton.upenn.edu, Lyle Ungar, John Holmes, Adrian Benton

We discuss medpie a tool to extract drugs and side effects from user generated content about medical conditions.

3 - Iterative Ranking from Pair-wise Comparisons

Sahand Negahban, Postdoc, Massachusetts Institute of Technology, Room D780, LIDS 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, sahandn@mit.edu, Sewoong Oh, Devavrat Shah

Aggregating pairwise comparisons to obtain a global ranking over a collection of objects has been of interest for a very long time: be it aggregating social opinions or deciding product suggestions. In most settings finding `scores' for each object is of interest to estimate the intensity of a preference. We propose a novel iterative rank aggregation algorithm for discovering scores for objects from pairwise comparisons and present has both theoretical and experimental justification for its use.

■ MB59

59- Phoenix West- Hyatt

Stochastic Decision Analysis with Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Katsunori Ano, Professor, Department of Mathematical Sciences, Shibaura Institute of Technology, 307 Fukasaku, Minuma-ku, Saitama, 337-8570, Japan, k-ano@shibaura-it.ac.jp

1 - MDP Approach for Optimization in Closed Loop Supply Chains

Kenichi Nakashima, Professor, Kanagawa University, 3-27-1 Rokkakubashi, Kanawawa-ku, Yokohama, 2218686, Japan, nakasima@kanagawa-u.ac.jp, Arvinder Loomba

This paper deals with a remanufacturing problem with stochastic variability in closed loop supply chain system. We model the system as a time average Markov Decision Process (MDP) with production/ordering quantity considerations. The cost function is assumed to be composed of cost factors such as holding, backlog, manufacturing costs etc. We obtain optimal production and ordering policy that minimizes expected average cost per period. Numerical results show implementation of the methodology.

2 - A Competitive Inventory Model under Customers' Strategies

Hitoshi Hohjo, Associate Professor, Osaka Prefecture University, 1-1, Gakuen-cho, Naka-ku, Sakai, Osaka, 599-8531, Japan, hojo@mi.s.osakafu-u.ac.jp

We consider a competitive inventory model with two retailers and their customers, and analyze it in the game theory. Each retailer decides ordering strategy so as to maximize his profit. And customers decide the first visiting retailer under the minimization of total cost with respect to moving and purchasing a product at the beginning of planning period. Our goal is to investigate the influence of strategies between retailers and customers.

3 - Optimal Threshold Probability in Markov Decision Processes with a Target and an Extinction

Masahiko Sakaguchi, Kochi University, Kochi, Japan, sakaguchi@kochi-u.ac.jp

We maximize a down-side chance probability of total costs until attaining a target set before hitting a cemetery set in undiscounted Markov decision processes. We formulate the process as infinite horizon case with a recurrent class. We show that an optimal value function is a unique solution to an optimality equation and there exists an stationary optimal policy. Also we give a policy improvement method.

■ MB60

60- Remington- Hyatt

NextGen Performance Metrics Part I

Sponsor: Aviation Applications

Sponsored Session

Ricardo Parra, Engineer, Federal Aviation Administration, 800 Independence Avenue SW, Washington DC 20591, United States of America, ricardo.parra@faa.gov

1 - Measuring Access: An Application of Poisson Regression

Tony Diana, Division Manager, NextGen Performance, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC, 20591, United States of America, Tony.Diana@faa.gov, Ricardo Parra

Access is the level of utilization achieved by a set of users authorized to use a NAS asset or service such as the airspace, airport, approach, runway, etc). It can also represent the level of diversity in defined user categories such as capability, performance during a defined period of time. The presentation discusses the application of Poisson regression techniques to the measurement of access.

2 - Joint Planning and Development Office Metrics for Evaluating NextGen Performance

Jerry Creedon, Professor, Old Dominion University, 3750 Elkhorn Avenue, Norfolk, VA, 23529, United States of America, jcreedon@odu.edu, Yuri Gawdiak, George Price

This paper summarizes a set of metrics for use in assessing projected performance of the Next Generation Air Transportation System (NextGen). The effort, guided by the six goals established in the 2004 Integrated National Plan for NextGen, formulated a concise set of metrics to assess the projected benefits of NextGen for each of several NextGen stakeholder groups.

3 - Evaluation of the Incremental Effects of NextGen Programs

Yu Zhang, University of South Florida, Civil and Environmental Engineering Dept, 4202 East Fowler Ave., Tampa FL 33620, United States of America, yuzhang@usf.edu

The benefits of NextGen programs, such as continuous descending approach, area navigation, have been extensively studied. Nevertheless, the incremental impacts of the programs and their mutual effects have not been investigated yet. This study scrutinizes the portfolio of NextGen programs at one representative airport and answers the questions by applying econometrics methods, e.g. Vector Autoregression Model.

4 – FY11 NextGen Performance Assessment

Almira Ramadani, FAA, NextGen, Systems Analysis and Modeling, 800 Independence Ave SW, Washington DC 20591, United States of America, almira.ramadani@faa.gov, E.J. Spear

This presentation summarizes operational performance impacts of a subset of NextGen capabilities fielded in FY11, for which the required empirical data was available, and enough time has passed since the implementation for a meaningful analysis to be possible. For each of the NextGen capabilities, we explain our methodology for identifying key performance metrics, present operational and performance impacts we expected to observe, and elaborate actual outcomes we observed post-deployment.

■ MB61

61- Russell- Hyatt

Routes, Slots, and Storms: Contemporary Issues in Managing Four-dimensional Trajectories in Air Traffic Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Mark Hansen, University of California at Berkeley, 114 McLaughlin Hall, Berkeley, CA, 94720, United States of America, mhansen@ce.berkeley.edu

1 - Value of Perfect Weather Information in the Probabilistic Air Traffic Management

Yoonjin Yoon, Assistant Professor, Korea Advanced Institute of Science and Technology, Dept. of CEE, 291 Daehak-ro, Yuseong gu, Daejeon, Korea, Republic of, yoonjin@kaist.ac.kr, Mark Hansen

In our previous study, we modeled a stochastic optimization of single-aircraft routing decision problem as a Geometric Recourse Model (GRM) during a weather disruption. In this paper, we utilize the same geometric setup to assess of the value of perfect weather information in probabilistic routing decision problem by solving both the stochastic GRM and the GRM with known clearance time. The results show that improvement with better weather information is limited with maximum saving of 10%.

2 - Equitable Resource Allocation Mechanisms during Reduced Airspace Capacity

Kleoniki Vlachou, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, kvlachou@umd.edu, David Lovell, Michael Ball

Part of the Airspace Flow Programs is the Collaborative Trajectory Options Program, where customers are allowed to submit cost-weighted sets of alternative trajectory options for their flights. In this research we propose a meaningful way for carriers to express some preference structure during AFP. We also propose a resource mechanism allocation that will improve the system efficiency and at the same time will take into account the preferences of the airlines.

3 - Algorithms for Dynamic Resequencing of En Route Flights to Relieve Terminal Congestion

James Jones, University of Maryland, Department of Civil and Environmental En, College Park, MD, United States of America, jonesjc1@umd.edu, David Lovell, Michael Ball

We present a set of algorithms designed to dynamically resequence flight arrival times of en route flights to both transfer and eliminate terminal delay. We also propose a strategy for transferring data between the systems and command centers and develop a process for assigning Controlled Times of Arrivals to flights en route. Analysis suggests that RBS-based algorithms provide strong throughput performance. This improvement is likely achieved, however, at the expense of fuel usage.

■ MB62

62- Borein A- Hyatt

Auction Theory

Cluster: Auctions

Invited Session

Chair: Thayer Morrill, North Carolina State University, Raleigh, NC, United States of America, thayer_morrill@ncsu.edu

1 - Stability and Competitive Equilibrium in Trading Networks

John Hatfield, Professor, Stanford Graduate School of Business, 655 Knight Way, Faculty Building East 313, Stanford, CA, 94305, United States of America, hatfield_john@gsb.stanford.edu, Scott Duke Kominers, Alexandru Nichifor, Michael Ostrovsky, Alexander Westkamp

We introduce a model in which agents in a network can trade via bilateral contracts. We find that when continuous transfers are allowed and utilities are quasilinear, the full substitutability of preferences is sufficient to guarantee the existence of stable outcomes for any underlying network structure. Furthermore, the set of stable outcomes is essentially equivalent to the set of competitive equilibria, and all stable outcomes are in the core and are efficient.

2 - Decentralized Auctions for Uniformly Semimodular Bidders
Mahyar Salek, Post-Doc Researcher, Microsoft Research Cambridge, 7 J J Thomson Avenue, Cambridge, CB30FB, United Kingdom, mahyar@microsoft.com, Richard Steinberg

Kelly and Steinberg (2000) introduced PAUSE, as a decentralized combinatorial auction for bidders with supermodular valuations. In this work, we extend their result to bidders with submodular valuations. We first define an abstract framework in which we generalize some bounds on the revenue of PAUSE. As a concrete instance of this abstraction, we define subPAUSE for submodular bidders. We demonstrate desirable properties of subPAUSE as compared with popular auctions in theory and practice.

3 - Design Issues for Combinatorial Clock Auctions
Lawrence Ausubel, Professor, University of Maryland, Department of Economics, Tydings Hall, College Park, MD, 20742, United States of America, ausubel@econ.umd.edu

The combinatorial clock auction (CCA) is a recent innovation in market design. It has been adopted for spectrum auctions in the UK, Denmark, Netherlands, Ireland, Canada and Australia. This paper explores some critical design issues. It considers features intended to limit strategic manipulation. It shows deficiencies in points-based activity rules and advantages in revealed-preference rules. It assesses implementation issues involving reserve prices and with large numbers of regional licenses.

4 - Optimal Auctions for Spiteful Bidders
Pingzhong Tang, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, kenshin@cs.cmu.edu, Tuomas Sandholm

We derive the optimal auction for spiteful (and altruistic) bidders. It chooses an allocation that maximizes bidders' generalized virtual valuations. The payment rule is less intuitive. It takes each bidder's own report into consideration. Bidders pay even if the seller keeps the item. The auction sometimes subsidizes losers when another bidder wins. We derive a revenue equivalence and present a template for comparing the revenues of any auctions that have the same allocation rule for the prior.

■ MB63

63- Borein B- Hyatt

Decision Analysis and Behavioral Operations

Sponsor: Behavioral Operations

Sponsored Session

Chair: Yael Grushka-Cockayne, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu

1 - Distributed Choices in Networks: Routing of Splittable Flow
Eyran Gisches, University of Arizona, 1130 E. Helen Street, Tucson, AZ, 85721, United States of America, eyran@email.arizona.edu, Amnon Rapoport

The Braess Paradox is a counterintuitive finding that upgrading a network may increase users' cost. Our goal is to determine theoretically and empirically if users may benefit when the population consists of groups that operate as unitary players. We have players choose routes in a network game under two conditions. In one, each user controls a single unit. In the second, users control multiple units which may be split. Our results show that in both conditions behavior converges to equilibrium.

2 - Buyback versus Revenue Sharing Contracts: Influence of Loss Aversion
Yinghao Zhang, University of Minnesota, Suite 3-150, 321 19th Ave., S, Minneapolis, MN, 55108, United States of America, zhang786@umn.edu, Karen Donohue, Tony Cui

We investigate how suppliers set contract terms for buyback and revenue sharing contracts, and how their decisions influence profit. Using a combination of theory and lab experiments, we find that in low critical ratio, the results are similar to the channel coordination case while in high critical ratio, both contracts yield a lower profit with revenue sharing slightly better than buyback. These results are consistent with loss aversion and a desire to minimize ex post inventory error.

3 - Learning to Price from Bounded Rational Competitors
Kay-Yut Chen, Principal Scientist, HP Labs, 1U-2, HP Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com, Shelen Jain, Guillermo Gallego, Jay Wang, Jose Beltran

We propose a new pricing method in markets where observed prices may be near, but not on equilibrium. A firm can "learn" from the limited intelligence in the market place. Simulated results show that the level of benefits depends on relative levels of intelligence between the firm, and the market.

4 - Bargaining in Supply Chains
Stephen Leider, Assistant Professor, University of Michigan Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, leider@umich.edu, William Lovejoy

We study experimentally bargaining in a multiple-tier supply chain with sequential bargaining between tiers. Our treatments vary the cost difference between firms in tiers 1 and 2, with larger cost differences reflecting increased bargaining power. We measure how these underlying costs influence the efficiency and profit distribution with the supply chain, and the extent to which bargaining power and fairness concerns influence the negotiated prices.

5 - The Wisdom of Competitive Crowds
Yael Grushka-Cockayne, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu, Casey Lichtendahl, Phil Pfeifer

We analyze a forecasting competition in which a prize is awarded to the forecaster whose point forecast is closest to an outcome. In a set of equilibrium results, we characterize the strategic forecasting. We find that the competitive crowd's forecast is more accurate than the average of truthful forecasts.

■ MB66

66- Ellis West- Hyatt

Knowledge Transfer and Classifier Selection

Sponsor: Data Mining

Sponsored Session

Chair: Si-Chi Chin, The University of Iowa, 3087 LIB, Iowa City, IA, 52242, United States of America, si-chi-chin@uiowa.edu

1 - Knowledge Development and Knowledge Transfer in New Product Development Projects
Wenli Xiao, University of San Diego, School of Business Administration, Olin Hall 335, 5998 Alcala Park, San Diego, CA, 92110, United States of America, wenlixiao@sandiego.edu, Cheryl Gaimon, Janice Carrillo

We introduce a dynamic model that characterizes linkages among three stages of engineering activities in an NPD project: prototyping, pilot line testing, and production ramp-up. The manager pursues knowledge development and transfer over time. Through knowledge transfer from a source to recipient stage, the manager enhances the recipient's knowledge development capabilities. We examine how the effectiveness of knowledge development, prior knowledge, and feedback impact the manager's strategies.

2 - Organizational Learning and Knowledge Transfer in a Multi-product Offshore Manufacturing Environment
Carolyn Denomme, Carnegie Mellon University, 5000 Forbes Avenue, 129 Baker Hall, Pittsburgh, PA, 15213, United States of America, cdenomme@cmu.edu, Linda Argote, Erica Fuchs, Dennis Epple

This work explores the significance of a multi-product environment on organizational learning & knowledge transfer by studying a US-owned overseas high tech manufacturing facility that produces variants of 4 focal products plus other miscellaneous products. We draw on 10 years of firm archival data and qualitative data collected to shed insights into why knowledge transfers across some products and not others by examining technological and organizational differences in these product transitions.

3 - Enhancing Knowledge Base with Knowledge Transfer
Si-Chi Chin, The University of Iowa, 3087 LIB, Iowa City, IA, 52242, United States of America, si-chi-chin@uiowa.edu, W. Nick Street

This presentation motivates the problem of Knowledge Base Enhancement (KBE), discusses the research methodology and proposes knowledge transfer network to describe the dynamic process of knowledge transfer. This interdisciplinary research crosses the study area of information filtering, machine learning, knowledge representation, and network analysis. It aims to explore and identify knowledge transfer methods to address the challenge of incomplete labelled data.

4 - A Classifier-Based Distance Metric for Ensemble Prediction
Senay Yasar Saglam, PhD Candidate, The University of Iowa Department of Management Sciences, S210 John Pappajohn Business Building, Iowa City, IA, 52242-1000, United States of America, senay-yasarsaglam@uiowa.edu, W. Nick Street

We propose methods of ensemble classification based on a new measure of distance between points. We map data points into a new space defined by the class probability estimates from a pool of two-class classifiers. Then, we use the Euclidean distance to measure the distance between data points in this space. We integrate this method with k-nearest neighbor procedures and KNORA in our experiments. Our findings show that our proposed method improves accuracy.

■ MB67

67- Ellis East- Hyatt

Advances in Bayesian Reliability Modeling and Risk Analysis

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Refik Soyer, Professor of Decision Sciences, George Washington University, 2201 G Street, Washington, DC, United States of America, soyer@gwu.edu

1 - Utility of Dependence, Departure from Independence, and Bayesian Reliability

Ehsan Soofi, Distinguished Professor, University of Wisconsin-Milwaukee, Lubar School of Business, P.O. Box 742, Milwaukee, WI, 53201, United States of America, esoofi@uwm.edu, Nima Jalali, Nader Ebrahimi

We formulate dependence in terms of the utility of predicting a variable from other variables. This approach integrates ideas from classic literature on dependence, the Bayesian expected utility in terms of uncertainty reduction, and measuring departure of a dependent model from the independence. We present applications to lifetime models such as Bayesian predictive joint distribution of components of a system and shock models, and Bayesian test of equality of parameters of lifetime models.

2 - Bayesian Variable Reliability Growth Modelling

Thomas Mazzuchi, Professor, George Washington University, 1776 G St. NW, Washington, DC, 20052, United States of America, mazzu@gwu.edu

In this talk, we present an overview of Bayesian Reliability Growth Modelling. Further, we develop a new model for Bayesian Reliability Growth Modeling which can account for various a priori growth patterns. The posterior distributions for all quantities of interest must be obtained via MCMC methods. We illustrate our methodology with real and simulated data.

3 - Modeling Heavy-Tailed, Skewed and Peaked Uncertainty Phenomena with Bounded Support

Johan van Dorp, Professor, George Washington University, 1776 G St., NW, #135, Washington, DC, 29952, United States of America, dorpjr@gwu.edu

A prevalence of heavy-tailed, peaked and skewed uncertainty phenomena have been cited in literature dealing with economic, physics, and engineering data. Herein, the family of Elevated Two-Sided Power (ETSP) distributions shall be presented. We demonstrate that the ETSP family allows for a remarkable flexibility when modeling bounded heavy-tailed and peaked, but skewed, uncertainty phenomena. We present an illustrative example utilizing 2008 US income data.

4 - Multivariate Distributions Induced by Dynamic Environments

Refik Soyer, Professor of Decision Sciences, George Washington University, 2201 G Street, Washington, DC, United States of America, soyer@gwu.edu

We consider multivariate distributions that arise as a results of components sharing a common operating environment. The operating environment follows a discrete time stochastic process and modulates failure characteristics of individual components. We discuss characteristics of the resulting multivariate models and develop Bayesian inference for their analysis.

■ MB68

68- Suite 312- Hyatt

Financial Services Section Best Student Research Paper Competition

Sponsor: Financial Services Section

Sponsored Session

Chair: Aparna Gupta, Associate Professor of Quantitative Finance, Rensselaer Polytechnic Inst., 110 8th Street, Troy, NY, 12180, United States of America, guptaa@rpi.edu

1 - Market-reaction-adjusted Optimal Central Bank Intervention Policy in a FX Market

Sandun C. Perera, University of Texas-Dallas, Dallas, TX, United States of America, sandun.perera@utdallas.edu

Motivated by empirical observations, we study a central bank intervention problem in the foreign exchange market when the market observes and reacts to the bank's interventions. Impulse control theory is used to solve the problem of finding the optimal times, types and amounts of interventions. For this, we first model an impulse control problem when the controller's action affects the state as well as the dynamics of the state process for a random amount of time. We then apply our model to solve the central bank intervention problem. Our results suggest that the central bank would intervene less frequently (more frequently) and the optimal policy is more (less) expensive than its corresponding value without the market reactions if the market reactions increase (decrease) the exchange rate volatility.

2 - Optimal Order Routing in a Fragmented Market

Hua Zheng, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, hzheng14@gsb.columbia.edu

In modern equity markets, participants have a choice of many exchanges at which to trade. Exchanges typically operate as electronic limit order books operating under the "price-time" priority rule. Taking into account the effect of investors' order routing decisions, we find that the equilibrium of this decentralized market exhibits a certain state space collapse property, whereby (a) the states at different exchanges are coupled in a fairly intuitive manner, (b) the behavior of the market is captured through a one-dimensional process that can be viewed as a weighted aggregate depth of the market at the best bid and offer, and (c) the behavior of the various exchanges is inferred through a set of simple mappings from that of the aggregated market depth process. This predicted dimension reduction is the result of high-frequency order routing decisions that essentially couple the dynamics across exchanges. We derive a characterization of the market equilibrium and the associated aggregated depth process. Analyzing a TAQ dataset for a sample of stocks over a one month period, we find strong support for the predicted state space collapse property.

3 - Dynamic Valuation of Delinquent Credit-card Accounts

Naveed Chehrazi, Stanford University, Stanford, CA, United States of America, nchehrazi@gmail.com

This paper introduces a dynamic model of consumers' repayment behavior on overdue (delinquent) credit-card loans placed in collections using a self-exciting point process. The models used to construct a probability measure for the collectability of a delinquent account. The resulting account-speci c dynamic collectability score (DCS) estimates, at any given time in the collections process, the probability of collecting a given percentage of the outstanding balance over a desired time horizon. The method is tested using a large set of account-level repayment data. The improvements in classi cation and prediction performance compared to standard bank-internal scoring methods are significant.

4 - The Valuation of Natural Gas-fired Power Plants by Integrating Spark Spread and Weather Options

Reaz-us Salam Elias, Ryerson University, Toronto, ON, Canada, m3elias@ryerson.ca

Spark spread based valuation of a natural gas-fired power plant addresses only the price risks emerging from the uncertainties of natural gas and electricity prices. A power plant, however, is also exposed to weather related risks. If the winter is mild, lower electricity generation leads to lower profit. Temperature fluctuations affect the profitability of the plant. In order to hedge the downside profitability, power plants can transfer weather related risks using temperature-based weather options. This research focuses on the integration of spark spread options with weather options in valuing a natural gas-fired power plant in a real options framework. This study addresses the financial risk issues of a natural gas-fired power plant and determines whether it is viable to integrate weather options with spark spread options; and how many options to long or short to minimize the variance of the total profit.

5 - Optimal Trade Execution with Dynamic Risk Measure and Primal-dual First-order Methods

Qihang Lin, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qihangl@andrew.cmu.edu

We study the optimal trade execution problem in an illiquid market by minimizing the coherent dynamic risk of the sequential transaction costs. The prices of the assets are modeled as a discrete random walk perturbed by both temporal and permanent impacts related to the trading volume. We show that, when the dynamic risk measure is Markovian, the optimal strategy is time-consistent and static. Formulating the optimal execution problem as a saddle point problem, we proposed specialized primal and dual first-order methods to compute the the optimal strategy. The efficiency and scalability of our approaches are demonstrated by numerical experiments.

■ MB69

69- Suite 314- Hyatt

Quantitative Methods in Portfolio Optimization

Cluster: Optimization in Finance

Invited Session

Chair: Ciamac Moallemi, Associate Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10025, United States of America, ciamac@gsb.columbia.edu

1 - Dynamic Portfolio Choice with Common Factor Shocks
Mehmet Saglam, Columbia University, New York, NY, United States of America, MSaglam13@gsb.columbia.edu, Ciamac Moallemi, Pierre Collin-Dufresne, Kent Daniel

We propose a factor-based model that incorporates common factor shocks for the security returns. Under these realistic factor dynamics, we solve for the dynamic trading policy in the class of linear policies analytically. Our model can accommodate stochastic volatility and liquidity costs as a function of factor exposures. Calibrating our model with empirical data, we show that our trading policy achieves superior performance in the presence of common factor shocks.

2 - On the Control of Diffusions via Linear Programming
Andrew Ahn, Columbia University, Department of IE&OR, 500 West 120th Street, New York, NY, United States of America, aja2133@columbia.edu, Martin Haugh

Han and Van Roy (2011) proposed a linear programming approach for the approximate control of diffusion processes. We extend that approach and apply it to a class of dynamic portfolio optimization problems with no short-sales and no-borrowing constraints. We also use portfolio optimization duality techniques to establish that the LP approach is capable of essentially solving these problems.

3 - Stress Scenario Selection by Empirical Likelihood
Wanmo Kang, Assistant Professor, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, Korea, Republic of, Wanmo.kang@kaist.edu, Paul Glasserman, Chulmin Kang

We present the selection and analysis of stress scenarios for financial risk assessment, with particular emphasis on identifying sensible combinations of stresses to multiple variables. We consider reverse stress testing - finding the most likely scenarios - using a nonparametric empirical likelihood estimator. We apply the results to marginal expected shortfall, macro stress scenarios, and scenario sampling method. This is a joint work with Paul Glasserman and Chulmin Kang.

4 - Optimizing Portfolios with Non-normal Distributions
John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu, Luis Chavez-Bedoya

Return distributions are well-known to have characteristics such as negative skewness and heavy tails that are not captured by normal distributions. We describe the characteristics of optimal portfolios with returns following a generalized hyperbolic (GH) distribution that accommodates many of the observed features absent from the normal distribution.

■ MB70

70- Suite 316- Hyatt

Digital and Social Networks II

Sponsor: Information Systems

Sponsored Session

Chair: Jui Ramaprasad, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3H2V1, Canada, jui.ramaprasad@mcgill.ca

1 - Towards an Ecosystem Theory of Information Technology Collaboration Networks
Ali Tafti, University of Illinois at Urbana-Champaign, 1206 S. Sixth Street, 350 Wohlers Hall, Champaign, IL, 61820, United States of America, atafti@illinois.edu

The production of information technology products and services involves a highly elaborate ecosystem of customers, collaborators, and competitors. In this study, I use a set of predictive statistical techniques to explore the determinants of positioning in an extended network alliances among IT-producing firms, as a means to develop more useful theories about how such IT ecosystems evolve.

2 - Maximizing the Potential of LinkedIn for Job Search
Rajiv Garg, Carnegie Mellon University, 4800 Forbes Ave., HBH 3030, Pittsburgh, PA, 15213, United States of America, rgarg@andrew.cmu.edu, Rahul Telang

Online professional networks (like LinkedIn) have been gaining popularity and are more frequently used by both job seekers and employers. This raises an important and unanswered question about the value of the building blocks of these networks for job search. In this paper we address these questions and present empirical findings that would allow job seekers to maximize the potential of these online professional networks.

3 - An Empirical Analysis of Digital Visibility
Lauren Rhue, New York University, Stern School of Business, 44 West 4th St., New York, NY, 10012, United States of America, lrhue@stern.nyu.edu

Increasingly, human interactions are either augmented or mediated by technologies, generating "digital visibility" in human behavior and introducing a social externality rooted in the anticipation of others' reactions. Variation among ties in friendship and reaction networks is leveraged to separate social influence from the influence of a digital audience.

4 - Value Co-creation in Crowdsourcing: The Effects of Social Networks on Product Co-Development Success
Hyelim Oh, McGill University, 1001 Sherbrook Street West, Montreal QC, Canada, hyelim.oh@mail.mcgill.ca, AnimeshAnimeshm, Alain Pinsonneault

Despite the popularity of diverse forms of crowdsourcing enabled by social media platforms, our understanding of performance drivers remains limited. Our study investigates how inventors' networks affect crowdsourcing performance. Our preliminary results suggest that inventors' structural position in the network and the composition of collaborators impact the success of product co-development.

■ MB71

71- Suite 318- Hyatt

Issues in Information Security, Fraud, and Location Awareness

Sponsor: eBusiness

Sponsored Session

Chair: Matthew Hashim, Assistant Professor of MIS, Eller College of Management, The University of Arizona, 1130 E. Helen St., McClelland Hall, Room 430, Tucson, AZ, 85721, United States of America, mhashim@email.arizona.edu

1 - Algorithmic Approaches to Fraud Prevention and Investigation
Dmitry Zhdanov, University of Connecticut, 2100 Hillside Rd, Storrs, CT, 06269, United States of America, dmitry.zhdanov@business.uconn.edu, Ram Gopal, Raymond Patterson, Erik Rolland

In this paper, we analyze a variety of algorithmic methods that can be used by the investigators of different fraud scenarios. We argue that the use of various social network overlays, coupled with graph theoretic concepts, is helpful in fraud investigation, particularly when fraud involves multiple perpetrators who may be insiders of the victim organization. We also present a set of consistent metrics that could be used to select and calibrate particular investigative techniques.

2 - E-Coupons Delivery Problems: A Dynamic and Stochastic Optimization Approach
Keumseok Kang, Florida International University, 11200 SW 8th Street, Miami, FL, 33199, United States of America, kskang@fiu.edu, Kemal Altinkemer, George Shanthikumar

Location based advertisement (LBA) enables advertisers to attract customers more effectively than ever, by sending location-aware advertisements, which we call e-coupons, through mobile devices. We consider a push-based LBA system and study a profit maximization problem of the advertiser, which we call the e-coupons delivery problem. We formulate this problem as a dynamic and stochastic programming model and find the structural properties of the optimal policy.

3 - A Dynamic Model of Emotions, Attitudes, and IS Security Policy Violations
John D'Arcy, University of Delaware, Newark, DE, United States of America, jdarcy@udel.edu

Research suggests that emotions play a prominent role in explaining employee deviance. In this study, we explore the dynamic nature of workplace events, emotions, and attitudes in predicting employees' deliberate IS security policy violations. The study is rooted in affective events theory and utilizes an experience-sampling methodology to assess within-individual variation in several of the study variables, including emotions.

4 - Collaboration, Interdependency, and Transfer Pricing
Matthew Hashim, Assistant Professor of MIS, Eller College of Management, The University of Arizona, 1130 E. Helen St., McClelland Hall, Room 430, Tucson, AZ, 85721, United States of America, mhashim@email.arizona.edu

Entities often engage in interdependent activities that may have an effect on other entities (e.g., airport security, health information exchanges). Using an experimental setting, we design several treatments using either endogenous or exogenous transfer pricing, and draw conclusions about the ability for subjects to achieve the optimal level of collaboration.

■ MB72

72- Suite 322- Hyatt

Advances in Optimization Modeling Languages and Systems III

Cluster: ICS-Advances in Optimization Modeling Languages and Systems

Invited Session

Chair: Robert Fourer, President, AMPL Optimization, Inc, 2145 Sheridan Road, Evanston, IL, United States of America, 4er@ampl.com

1 - Stochastic Programming in GAMS
Lutz Westermann, GAMS Development Corporation, 1217 Potomac St. NW, Washington, DC, United States of America, lwestermann@gams.com, Michael Bussieck

Recently GAMS made a first cut at supporting stochastic programming. With a few changes uncertainty can be added to an existing deterministic model. For this, the Extended Mathematical Programming (EMP) framework is used to replace parameters in the model by random variables. This way multi-stage recourse problems and chance constraint models can be formulated.

2 - Designing a User Friendly System for Planning under Uncertainty with Stochastic Programming (SP)
Linus Schrage, University of Chicago, 5807 S. Woodlawn, Chicago, IL, United States of America, linus.schrage@chicagobooth.edu, Mustafa Atlihan, Kevin Cunningham, Gautier Laude

Perhaps the most daunting challenge of SP is providing a user interface that is not daunting to the user. We describe the approach we have used in the SP component of the LINDO API optimization library. The two major tasks are eliciting from the user: 1) sequencing of decisions and random events, and 2) distributions of random variables, including dependencies. This library is accessible via the spreadsheet add-in What'sBest! and the modelling languages GAMS and LINGO.

3 - Network Optimization and Beyond in SAS/OR® Software
Leo Lopes, Advanced Analytics Specialist, SAS Institute, SAS Campus Drive, Cary, NC, 27513, United States of America, Leo.Lopes@sas.com

This talk demonstrates new features in the OPTMODEL procedure for network and combinatorial optimization. With PROC OPTMODEL, you can access a variety of network-based solvers by using only problem definitions instead of explicit formulations, greatly enhancing performance and scalability. You can also access most of the functionality of the SAS System by merging invocations of other SAS procedures with mathematical programming constructs that are built into the PROC OPTMODEL modeling language.

4 - GDXRRW: Exchanging Data between GAMS and R
Steven Dirkse, GAMS Development, 1217 Potomac St NW, Washington, DC, 20007-3212, United States of America, sdirkse@gams.com, Michael Ferris, Renger van Nieuwkoop

We discuss GDXRRW (GDX-R Read/Write), a tool for moving data between GAMS and R. This data exchange benefits both user communities. It gives R users the capability to use the superior modeling and optimization capabilities of GAMS, and it allows for visualization and analysis of GAMS data directly within R to take advantage of R's wide range of functionality. The freely available tool is based on GDX (GAMS Data eXchange), a well-established and public API for sharing data.

■ MB73

73- Suite 324- Hyatt

Default and Systemic Risk

Cluster: Quantitative Finance

Invited Session

Chair: Agostino Capponi, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47906, United States of America, capponi@purdue.edu

1 - Default Swap Games Driven by Spectrally Negative Levy Processes
Kazutoshi Yamazaki, Osaka University, CSFI, Osaka, Japan, k-yamazaki@sigmath.es.osaka-u.ac.jp, Tim Siu-Tang Leung

This paper studies game-type credit default swaps that allow the protection buyer and seller to raise or reduce their respective positions once prior to default. Under a structural credit risk model based on spectrally negative Levy processes, we apply the principles of smooth and continuous fit to identify the equilibrium exercise strategies for the buyer and the seller. We then rigorously prove the existence of the Nash equilibrium and compute the contract value at equilibrium.

2 - Filtered Likelihood for Point Processes
Gustavo Schwenkler, Stanford University, 1045 Alma St., Palo Alto, CA, 94301, United States of America, gschwenk@stanford.edu, Kay Giesecke

We develop likelihood estimators of the parameters of a marked point process and of incompletely observed explanatory factors that influence the arrival intensity. The factors follow arbitrary jump-diffusions. We provide conditions for consistency and asymptotic normality as the sample period grows. We also establish an approximation to the likelihood and analyze the convergence and asymptotic properties of the associated estimators. Numerical results illustrate our approach.

3 - The Topology of Central Counterparty Clearing Networks and Network Stability
Richard Sowers, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, r-sowers@illinois.edu, Rui Song, Jonathan Jones

We study a simple model of a trading network with central counterparties and Gaussian exposures. We are interested in the structure of rare events (Maximum Exposure at Risk). We identify a large-deviations-type result which captures some of the structure of rare events.

4 - Liquidity Impact of a Ban on Naked Credit-default Swaps
Agostino Capponi, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette IN 47906, United States of America, capponi@purdue.edu

We develop a dynamic search model to study the impact on market liquidity and credit risk of banning naked credit default swap (CDS) positions. In equilibrium, investors trade bonds and CDS protection directly and on over-the-counter markets (OTC). When OTC markets are well functioning, banning naked CDS positions raises market illiquidity and does not necessarily lower credit spreads. Bid-ask spreads increase proportionally to the benefits derived from using CDS as proxy hedging instruments. Such findings suggests that regulators should consider other measures to reduce instability from excessive speculation in derivatives market.

Monday, 12:30pm - 2:30pm

■ Interactive Session

West Ballroom Foyer, Level 300

Interactive Session

Cluster: Interactive Poster Session

Invited Session

Chair: Young-Jun Son, The University of Arizona, Systems and Industrial Engineering, Phoenix, AZ, United States of America, son@sie.arizona.edu

Co-Chair: Burcu Keskin, University of Alabama, Huntsville, AL, United States of America, bkeskin@cba.ua.edu

Co-Chair: Jian Liu, University of Arizona, Tempe, AZ, United States of America, jianliu@sie.arizona.edu

1 - A Research on Supply Chain Coordination in Unconventional Emergencies

Guwen Shen, School of Management,Huazhong University of Science and Technology, No.1037,Luoyu Road, Wuhan, China, sgwforever@gmail.com, Xianhao Xu

In this paper,we research the supply chain coordination under intervening measures by the government in unconventional emergencies,hoping to getting the government's optimal intervention mechanism in unconventional emergency and get the optimal coordination mechanism under the government's intervention measures in unconventional emergency.

2 - On Optimal Design of Multi-survey Internet Campaigns

Bogumil Kaminski, Assistant Professor, Warsaw School of Economics, Al. Niepodleglosci 162, Warsaw, 02-544, Poland, bkamins@sgh.waw.pl, Mariusz Kozakiewicz, Wit Jakuczun

We model a problem of optimal assignment of respondents to internet surveys. Respondents are invited online to participate in one of many surveys that are run in parallel. Each survey has a unique inclusion criteria based on respondent socio-demographic data and target number of times it has to be filled. We design a method that dynamically assigns respondents to surveys so as to minimize number of respondents questioned. The solution is implemented for a leading online survey company in CEE.

3 - A Better Ranking of National Soccer Teams via Optimization-based Method

Atsushi Takemasa, Chuo University, 13-27 Kasuga 1-chome,Bunkyoku,Tokyo JAPAN, Tokyo, Japan, atstakemasa@gmail.com, Jun-ya Gotoh

Ranking methods based on partial comparisons have been studied in various fields. In this study, we employ the Hodge ranking, an optimization-based ranking method, for grading more than 200 national soccer teams affiliated with FIFA. We first discuss how to measure the quality of ranking in the context of sports ranking and compare the results of the proposed method with the FIFA/Coca-Cola World Ranking. Several ways for modification will also be presented so as to improve the ranking quality.

4 - Measuring the Efficiency of the Libraries of a Public Institution of Higher Education in Brazil

Lasara Rodrigues, UFOP/BRAZIL, Campus Morro do Cruzeiro, Ouro Preto, MG, 35400000, Brazil, lasara@em.ufop.br, Marcella Pinto, Irce Guimarães

This paper present an approach based on Data Envelopment Analysis (DEA) used to investigate the efficency of 12 libraries from the Library Integrated System of a Public Institution of Higher Education in Brazil. BCC models driven to output were used due to the different sizes of DMUs analyzed. As result, the benchmark libraries as well as the efficiencies for each DMU, its scale factor and the targets for each inefficient DMU were obtained.

5 - Solving Nonlinear Multicommodity Network Flow Problem by Penalty Function Methods

Ali Darroudi, PhD Student, FIU, 10555 W. Flagler Street,, EC, Room 3730, Miami, FL, 33174, United States of America, ali_a_darroudi@yahoo.com, Hedayat Z. Aashtiani

Penalty-based algorithm is presented for solving the Multicommodity network flow problem (MNFL) with a nonlinear objective function and considering the side constraints. Side constraints will be relaxed, and a penalty term will be added for the violation of it to the objective function. This algorithm uses Hyperbolic, Liu and Dynamic penalty functions to eliminate side constraints. Frank-Wolf method is subsequently used to decompose the convex problem into a sequence of linear problems.

6 - Interpersonal Relationships and Inventors' Network Positions

Sebastiano Massaro, UCL & Boston University, Gower Street, London, United Kingdom, s.massaro@ucl.ac.uk, Daniele Rotolo

The structural perspective on networks disregards the role of actors' interpersonal dynamics in favor of topological configurations, to explain actors' behavior. Yet, different types of interpersonal relationships may favor (or not) actors' actions in building their network positions. Drawing on a mixed methods study in the nanotechnology sector, we argue that inventors who establish 'affective' relationships build stronger brokerage positions than those relying on 'instrumental' ties.

7 - Application of ELECTRE III for Personnel Selection Problem

Zülal Güngör, Prof, Gazi University, Engineering Faculty, Industrial Engineering Department, Ankara, Turkey, zulalg@gazi.edu.tr

The present work presents is an application of multi-criteria decision analysis (MCDA) for decisions in the area of personnel selection. MCDA is a general term for methods providing a systematic quantitative approach to support decision making in problems involving multiple criteria.This can be achieved only by employing potentially adequate personnel. The purpose of this paper is to provide methodologies for personnel selection problem, which are based on Electre III method.

8 - Performance Evaluation of Collaborative Healthcare Systems using Simulation

John Jung-Woon Yoo, Assistant Professor, Bradley University, 1501 W. Bradley Ave., Peoria, IL, 61625, United States of America, jyoo@bradley.edu, Krishnaveni Gnanasekaran

In our earlier research, we have proposed a collaborative medical service framework. We claim that through the proposed collaboration framework, healthcare service providers can have higher utilization of their resources, and the patients can reduce lead time for their treatments. To validate the performance of the proposed framework, a simulation study is conducted and the simulation results are discussed in this talk.

9 - Modeling for Equitable Allocation of Food Distribution in North Carolina under Capacity Constraints

Irem Sengul, North Carolina State University, 1010 Avent Hill, Apt. B8, Raleigh, NC, 27606, United States of America, isengul@ncsu.edu, Julie Ivy, Reha Uzsoy

In partnership with the Food Bank of Central & Eastern North Carolina, which works on a 34-county service area, this research focuses on determining the equitable distribution of donated food among people at risk for hunger. The factors that influence the solution are capacity, supply and demand. This poster presents deterministic, linear programming models used to derive structural properties and optimal policy for allocating additional storage capacity to the counties in the service region.

10 - An Approach to Approximating Contributions Received through Food Bank Collections at Grocery Stores

Luther Brock, North Carolina A&T State University, 1601 East Market Street, Greensboro, United States of America, lgbrockiii@hotmail.com, Lauren Davis

This research addresses the need to approximate how much food is received by food banks through collections at grocery store. Such forecasts are the basis for more cost-effective vehicle scheduling. A feed-forward artificial neural network (FF-ANN) is used to estimate the amounts of different in-kind goods received through isolated store collections. The FF-ANN is trained using donation records provided by a food bank in the southeastern United States and compared with linear regression.

11 - Activity-based Costing or Lean Accounting: Choices of Chinese Enterprises in the Transition

Danxia Guo, Associate Professor, Xiamen University, Longhunan 4th Lane, Apt 13-302, Xiamen, FJ, 361000, China, dxguo6204@163.com

As the investment-based development model among Chinese enterprises has lost its sustainability, enterprises are eager for a transformation to an efficient cost-orientated business model in order to maintain rapid growth. By analyzing differences between activity-based costing and lean accounting, this article demonstrates criteria and principles in selection, forecasts obstacles in application, and makes assumptions for lean accounting research, which point out a direction for empirical study.

12 - The Role of Trust in University-Industry Collaborative Research Partnership Performance

Lynette Wilcox, Doctoral Candidate, Virginia Tech, 565 Whittemore Hall, Blacksburg, VA, United States of America, lywilcox@vt.edu

Empirical studies on the roles of interpersonal and inter-organizational trust in university-industry collaborative research partnership performance may provide external validation to current findings which are contextually dominated by supply chain relations. Considering the cultural differences between academe and industry, combined with inherent uncertainty and risk associated with research and technology development, the role of trust could be more evident in this emergent context.

13 - Capacity Planning in the Departmant of Corporate Resource Planning at Turkish Aerospace Industries
Gözde Arslan, Master Student, Gazi Universitesi Mühendislik Fakültesi, Maltepe/Ankara, Turkey, gzdcn@hotmail.com

The management of capacity planning systems are becoming more and more important for manufacturing firms in this ever-increasing competitive marketplace.In this study,we examine special test machine which was determined bottlenecks in this study.To eliminate bottlenecks were prepared the addressing design matrix which was tested. In addition, a parametric method has been developed for the determination of the duration of the test machine parts.

14 - Difficulties Mitigating Cybercrime in the Banking Sector
Michael Mitchell, Programming Analyst, Sandia National Laboratories, P.O. Box 5800, MS 1138, Albuquerque, NM, 87185-1138, United States of America, micmitc@sandia.gov, Walter Beyeler

Cybercrime against retail payment systems is increasing. This study analyzes the factors which make cybercrime mitigation in the retail payment system difficult. Some of the factors considered for this study include how much money is stolen by cybercriminals, its impact on consumers, which stakeholders bear the burden of risk, and cost implications for combating cybercrime.

15 - Zigzag Search for Multiple Objective Optimization
Honggang Wang, Rutgers University, 96 Frelinghuysen Road, CoRE Building, Room 212, Piscataway, NJ, 08854, United States of America, honggang.w@rutgers.edu

We propose a new method, using a gradient-based zigzag search approach, for multi-objective optimization (MOO) or vector optimization problems. The key idea of this method is searching around the Pareto front by applying an efficient local-search procedure using the gradients of the objective functions. A simple implementation of this method, z-algorithm, is presented particularly for continuous bi-objective optimization (BOO) problems with well-connected Pareto optimal solutions.

16 - Value of Perfect Information in Containership Load Planning
Masoud Hamedi, Assistant Research Scientist, University of Maryland, 1173 Glenn L. Martin Hall, Bldg #088, Dept. of Civil & Environmental Eng, College Park, MD, 20742, United States of America, masoud@umd.edu, Ali Haghani

This paper describes implications of having access to perfect container demand information while planning load and unload operations for a cellular containership. The optimization model in this study is different from traditional stowage planning, such that minimizing unnecessary container shifts and maximizing quay crane utilization are considered simultaneously. The model is used to analyze sample problems under different scenarios in a multi-port voyage.

17 - A Model of Platform Transition in Retail Payment Systems
Walter Beyeler, PMTS, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, 87185-1138, United States of America, webeyel@sandia.gov, Angie Kelic, Michael Mitchell

Technological innovations are inspiring tremendous innovation in retail payments processes. Platform economics have been used to understand traditional systems for retail payments such as credit cards, explaining the structures of incentives among the various kinds of participants. We build on this analysis to understand the possible dynamics of transitions to novel payment systems, and to include the influence of the security of transactions and information on uptake.

18 - Planning for Integration of Wind Power Capacity in Power Generation using Stochastic Optimization
Yashar Aliari, PhD Candidate, UMD, Civil Eng. Dept., 4329 Rowalt Dr Apt 202, College Park, MD, 20740, United States of America, yaliyari@yahoo.com, Ali Haghani

Wind-generated power has a stochastic nature and it is generally used in combination with more reliable sources of energy. Therefore, it is important to investigate how much capacity from each available source of energy should be installed in order to meet electricity demand at the desired reliability level considering cost and environmental implications. For this purpose, a probabilistic optimization model is proposed which is capable of assigning optimal capacity levels for each energy source.

19 - Food Security is Associated with Dietary Diversity Scores of Small Households in Rural Area
Ru Feng, Dalian University of Technology, No. 2 Linggong Road,Ganjinzi, Dalian, LN, 116033, China, fengru719@gmail.com, Gang Song

Food security- an increasingly important issues in the whole world-makes a significant contribution for human's good nutrition and health. This paper provides an overview of recent studies and statistics on food security. It focuses on 9-item questions and dietary diversity scores to evaluate the food security status. By analyzing the data of Kamuli and comparing other five cities in Asia and Africa, it gives a measurable model to examine the contribution of food security.

20 - Time-cost Trade-off Analysis with Workload Buffers
Tomasz Blaszczyk, University of Economics, 1 Maja 50, Katowice, 40-287, Poland, tomasz.blaszczyk@ue.katowice.pl, Pawel Blaszczyk

In this paper we propose a new approach to project modeling for the application of time-cost analysis. We use the concept of project buffers for the estimation of the workload on the job. On the basis on the results of earlier work on the problem of modeling time and cost buffers, we propose the construction of multi-criteria model compiled on the basis of single objective buffers work.

21 - A Study of Relationship about Homogeneity and Differences among Internet Enterprises
Xiong Yingzi, Xiamen University, School of Management; Xiamen University, Xiamen, FJ, 361005, China, xyingzi@xmu.edu.cn, Zhiduan Xu

We intend to interpret the causes of homogenization among Internet enterprises through establishing the competition model of two enterprises. It shows that homogenization is the result of rational choice on the part of an enterprise. The characteristics of network technologies and network products/services constitute a sufficient condition under which homogenization can be fulfilled. The competitive advantages of large Internet enterprises come from the differentiation based on the homogeneity.

22 - Dividing a Territory with Obstacles
Raghuveer Devulapalli, University of MInnesota, 310 8th St SE #205, MInneapolis, MN, 55414, India, me.raghuveer@gmail.com, John Gunnar Carlsson

We consider the problem of dividing a simply connected polygon containing a set of simply connected obstacles into sub-regions so as to balance the workloads of a collection of n fixed facilities or vehicles over that territory. We give a fast analytic center cutting plane method that divides the territory into n compact, connected sub-regions, each of which contains a facility, such that the workloads in each sub-region are balanced.

23 - Considering a Firm's Tech. Strategy in the Link between Inventor Mobility & Interfirm Knowledge Flow
Erin McKinney, PhD. Student, Carnegie Mellon University, 5812 Howe St., #21, Pittsburgh, Pe, 15232, United States of America, emckinne@andrew.cmu.edu

Inventor mobility is recognized as related to the flow of knowledge across firms. This paper claims that when an inventor's background fits the technological strategy of the firm recruiting him, there will be an increase in the firm's use of the recruits' prior ideas but not if his background lacks this fit. We use patent data to look at mobility and identify inventors who fit their hiring firm's technological strategy.

24 - Predicting Client Appointment Adherence to Improve Utilization at a Large Mental Healthcare Provider
Nathan Nehrt, Data Analyst/Predictive Modeler, Centerstone Research Institute, 720 North Marr Road, Columbus, IN, 47201, United States of America, nathan.nehrt@centerstone.org, Jason Luellen, Russell Galyon

Low appointment adherence, i.e. clients not showing up for scheduled appointments, has been a major challenge for community mental healthcare providers. We evaluate predictive models for appointment adherence based on client clinical, demographic, and prior appointment data and treatment facility and appointment time characteristics. Several models demonstrate significant predictive improvement over baseline adherence rates and could improve appointment slot utilization and increase revenue.

25 - Primal-Dual Heuristic for Path Flow Estimation in Medium to Large Networks
Shikai Tang, The Institute of Transportation Studies at UC Davis, 2028 Academic Surge, Davis, Calif. 95616, Davis, CA, 95616, United States of America, skytang@ucdavis.edu

The Path Flow Estimator (PFE), an Origin-Destination (O-D) estimation algorithm that relies on the computation of path flows, can be slow when applied to medium large networks. We develop a primal-dual heuristic that can significantly improve the efficiency of the PFE algorithm, and enables its application in medium to large networks with considerably less computational time.

26 - Statistical Pattern Recognition for Real-time Ridesharing
Keivan Ghoseiri, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, kghoseir@umd.edu, Masoud Hamedi, Ali Haghani

In the face of increasing the transportation cost and worsening the effects of traffic congestion and environmental pollutions, an easy, safe and quick to respond real-time rideshare system is a wise usage of personal cars. This paper employs statistical pattern recognition tools such as Principal Component Analysis and Discriminant Analysis to extract hidden patterns of ridesharing from a data warehouse generated by a verified spatiotemporal and hierarchical matching strategy.

27 - A Logistic Regression Model for Prediction of Accidents Associated with Changeable Message Signs

Azadeh Norouzi, University of Maryland, 1173 Glenn L. Martin Hall, Bldg #088, College Park, MD, 20742, United States of America, norouzi@umd.edu, Ali Haghani, Masoud Hamedi

Recently, some concerns have been raised about the negative impacts of CMSs on road safety including drivers' distraction and accidents resulted from slowing down. This paper investigates the meaningful relationship between the frequency of accidents and their proximity to CMSs using the ground truth incidents data in Maryland. The paper presents a logistic regression model to predict accident frequencies depending on the visibility, contents and type of messages, and distance from CMS.

28 - Optimizing a Cloud-based Service Design using Social Media

Amir Zadeh, OSU, 101 Hanner Hall Stillwater Campus, Stillwater, Ok, 74075, United States of America, amir.zadeh@okstate.edu, Ramesh Sharda

Today, service providers offer a number of computing services on clouds and each of these services has different characteristics as regards price, security, compliance and competition, quality issues. On the other hand, individual and social influences play an important role in a consumer's service choice. In this paper, a cloud-based service design problem affected by peer influence is developed to the optimize service provider's profit and to incorporate social interactions.

29 - Dynamic Pricing and Delivery in Smart Grid with Strategic Consumers

Shaudi Mahdavi-hosseini, university of pennsylvania, 220 South 33rd Street, Philadelphia, PA, 19104, United States of America, shaudi@seas.upenn.edu, Yan Lee Shu

The digitally-enabled "smart" energy grid enables instantaneous adjustments in pricing and supply of electricity. However, the minute-by-minute record of customers' energy use enabled by the grid poses a threat to consumer privacy. Here we extend prior work by modeling a setting (and studying the game that emerges) in which customers are strategic, and the utility delivers/prices energy on the basis of energy usage information transmitted in a private way.

30 - Equilibrium Model for Analysis on Opening and Improving Transportation Routes

Kazuhiko Ishiguro, Associate Professor, Kobe University, 5-1-1, Fukaeminami, Higashinada, Kobe, 658-0022, Japan, ishiguro@maritime.kobe-u.ac.jp, Pitu Mirchandani

Transport cost reduction will trigger new transport demand. This study develops international trade model taking account of ocean carriers' behavior based on multi-regional computable general equilibrium framework. Trade amount is formulated as the demand of goods produced in other region. The model is applied to opening and improving transportation routes and the impacts on trade are discussed.

31 - An Optimal Lane-Based Signal Merge Control Model for Freeway Work Zone Operations

Yue Liu, Assistant Professor, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, 53201, United States of America, liu28@uwm.edu, Jing Mao

This paper presents a dynamic control model for optimizing lane-based signal merge (LBSM) operations at freeway work zones. The control objective is to maximize the throughput. GA is employed to solve the model. Results reveal that the proposed method yields much better performance than traditional merge strategies under heavy traffic conditions.

32 - Optimal Decision-making between Signalized and Uninterrupted Flow Strategies during Evacuation

Zhenke Luo, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, 53201, United States of America, zluosr@uwm.edu, Yue Liu

This paper presents a bi-level network optimization model to determine the optimal set of intersections in the evacuation network for implementing uninterrupted flow and signal control strategies, respectively, which can yield the maximum evacuation operational efficiency and the best use of available budgets. The proposed model is solved by a GA-based heuristic.

33 - Cluster-based Optimal Location Planning of Urban Transit Hubs

Jie Yu, Associate Professor, Shandong University, No. 17923 Jingshi Rd, Jinan, China, yujie1979@gmail.com, Yue Liu, Zhenke Luo

This paper presents an optimization model planning urban transit hub locations. The model features a bi-level structure with the upper-level determining the hub locations to minimize the total transportation and facility cost. The lower-level models the behavior of buses and passengers in choosing optimal hubs and transportation routes. GA is employed to yield meta-optimal solutions.

34 - Material Allocation, Routing and Dispatch System (MARDS)

Tanju Yurtsever, Maxim Integrated Products, 14900 Spillman Ranch Loop, Austin, TX, 78738, United States of America, tanju.yurtsever@maxim-ic.com, Jessica Brown, Michael Bates

In Semiconductor Manufacturing, assigning products to the right tool and having them to be moved to the right location and processing them in the right order is very important for productivity. In MAXIM San Antonio Fab, we designed, developed and implemented a system that will find the best allocation, routing and dispatch decisions in real time in a manufacturing environment with about 1000 product moves through 1000 equipment in an hour.

35 - Real-time Feedback Control for Home Care Crew Scheduling

Seokgi Lee, PhD. Candidate, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, seok.lee75@gmail.com, Vittal Prabhu, Yuncheol Kang

We develop dynamic models for the home care crew scheduling problem (HCCSP) with dynamic patient appointments based on the theory of the nonlinear and discontinuous differential equation, and explain dynamics that span from controlling crew work times to home-visit scheduling and off-time planning. Also, the real-time feedback control algorithm based on the discrete event simulation is presented to solve HCCSP in a distributed system environment.

36 - Rule-Based Production Planning and Scheduling using Decision Tree

Hassan Gholami Mazinan, Logistic Expert, SAIPA, 14 km, Ardestan Rd, SAIPA Kashan Co., Kashan, 87135/1488, Iran, mazinan.hassan@gmail.com, Maziar Davoodi, Erfan Khaji, Keivan Ghoseiri, Mahyar Hoseinzadeh

Production planning and scheduling may require the solution of a complex large-scale problem. This paper presents a rule-based plan to tackle associated complexities of the problem. The paper compares hidden production rules generated from data mining tools such as Decision Tree with judgmental production rules in SAIPA Kashan automaker. The classifier approach generates proper rules and removes weak rules. The implemented results show effectiveness of data mining methods in production planning.

37 - Echelon Inventory Model with Fuzzy Approach and Heuristic Solution for Supply Chain Management

Hoda Atef Yekta, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, hoda.atefyekta@business.uconn.edu, Milad Avazbeigi, Mohammad Reza Akbari

This research proposed a nonlinear mixed integer model for Inventory management in an integrated Supply Chain with fuzzy inputs. The objective is minimizing the inventory costs of chain while considering the restriction of fill rate of final products and determine the review period time and order-up-to level of each inventory.

38 - Heuristic Algorithms for Locating the Alternative-Fuel Station Infrastructure on A Large-Scale Network

Yu-jiun (June) Tsai, Texas A&M University, Department of Industrial Engineering, College Station, TX, United States of America, yjt2009@tamu.edu

Flow refueling location model (FRLM) is used to locate a fixed number of fuel stations on a road network to maximize the roundtrips between origin and destination (O-D) pairs given the limited range of alternative-fuel vehicles. In this work, we propose a modified formulation, applying branch-and-bound, to solve the problem more efficiently. We also deploy heuristic approach to solve the problem for large-scale networks.

39 - A New Methodology to Model Construction Project Supply Chain

Kiavash Parvan, PhD Student, University of Maryland, 3405 Tulane Dr. Apt#14, Hyattsville, United States of America, kparvan@gmail.com, Hazhir Rahmandad, Ali Haghani

Uniqueness and complexity are two features that distinguish construction projects from many routine work processes. These two are the main sources of uncertainty in project prediction. The current project management tools are not able to consider change and project activities dependency. The proposed methodology introduces a new model to predict project outcomes in form of probability distributions, considering change and design-construction inter-relationship.

40 - Cycling Behavior, Self-Image, and Identity: Insights from Agent-Based Modeling

Michael Maness, University of Maryland, 1173 Glenn Martin Hall, Department of Civil and Env. Engineering, College Park, MD, 20742, United States of America, mmaness@umd.edu

This research incorporates the concept of social identity into the modeling of cycling behavior. To explore this, an agent-based model of cyclists-motorists interaction with a central infrastructure planner was created. Heterogeneous agents are given rules that balance their travel needs with their self-image by exploring and expressing their cyclist identity and interacting with others. A central planner oversees these actions and adjusts the infrastructure to the planner's and agents' goals.

41 - The Statistical Analysis of the Housing Bubble in the US Metro Areas

Hamed Ahangari, Research Assistant, University of Connecticut, 1 Northwood Rd., Apt 108, Storrs, CT, 06268, United States of America, hamed.ahangari@uconn.edu, Dennis Heffley, Norman Garrick

This paper focused on the housing bubble issue and measured it based on the statistical model. This measurement is based on the magnitude and scale of the bubble. Also, this study developed a model for categorization and location analysis of the bubble in US metro areas during 2000 - 2010.

42 - Modeling the Fuzzy Inventory Routing Problem with Backlogging

Ensieh Mohseni, Project Control Expert, Peyk Asa CO., No. 10, #4 Alley, Sadeghi Street, West corner of Sharif University, Azadi, Tehran, +98, Iran, e_mohseni@aut.ac.ir, Hoda Atef Yekta, Mohamad Hossein Fazel Zarandi

This paper presents a new fuzzy inventory routing problem with backlogging(FIRPB). In the proposed model, triangular fuzzy numbers are used for fuzzy demands, fuzzy unit shortage costs and fuzzy unit holding costs. Here, the developed model consists of multi periods and single depot. To solve such a model, a heuristic method is presented. Finally, results of the fuzzy heuristic method are analyzed.

43 - A Decision Support Framework for Healthcare Transition Programs to Reduce Hospital Readmissions

Sabrina Casucci, PhD. Candidate & Research Assistant, University at Buffalo, SUNY, Department of Industrial & Systems Eng., Amherst, NY, 14260, United States of America, scasucci@buffalo.edu, Li Lin, Alexander Nikolaev

High hospital readmissions signal poor quality of post-hospital care and unnecessarily increase healthcare costs. Intervention programs aim to reduce readmission rates; yet there is little support for understanding the effect of physician and patient care decisions on the program outcomes. This paper focuses on the complexities of transitional care and the design of informative stochastic models that can provide decision support to all the stakeholders.

44 - A Non-linear Correlation Metric

Ed Ramsden, Sensata Technologies, 529 Pleasant Street, Attleboro, MA, 02703, United States of America, earamsden@comcast.net

Pearson and Spearman correlation is useful for identifying linear or monotonic functional relationships between data variables, but are less useful for identifying the presence of non-linear relationships that would be apparent in a graphic plot. We propose a new correlation metric based on the ability to predict data from local neighbors that can identify the degree of linear and non-linear relationships that may exist between two variables in the presence of noise.

45 - A Markovian Inventory Model for Inventory Record Inaccuracy in Retail Stores

Amir Zadeh, OSU, 101 Hanner Hall Stillwater Campus, Stillwater, Ok, 74075, United States of America, amhnzadeh@gmail.com

This paper proposes a Markovian inventory model to study the impacts of inventory record inaccuracy stemming from theft error in retail stores on a continuous review lost sale (s, Q) inventory system. This model is analyzed across two scenarios depending on which technology is deployed to optimize replenishment decisions: (1) Barcode technology; (2) RFID.

46 - A Conceptual Design and Estimated Costing for CdTe PV Factory

Hershall Shelley, Graduate Student and Professor, Colorado State University and Solar Energy and Engineering Systems, 2401 Greenlee Drive, 2401 Greenlee Drive, Austin, US, 78703, United States of America, hshelley@engr.colostate.edu

The development of a procedure is critical to an emerging product. An interactive computer parametric modeling tool will help the decision making process. This study by Bonnet is used as the baseline for a modeling and analysis tool for analyzing defender and challenger factory costs. The model is used to estimate associated expenses for defender and challenger factories. An ABC method is also presented. Finally, a defender and challenger replacement analysis is presented.

47 - An Overview of Integrated Network Design and Scheduling Problems

Sarah Nurre, PhD Student, Rensselaer Polytechnic Institute, 110 8th Street CII 5015, Troy, NY, 12180, United States of America, nurres@rpi.edu, Thomas Sharkey

We discuss the new problem class denoted Integrated Network Design and Scheduling (INDS) Problems. A broad overview of INDS problems will be presented, including complexity results, solution methods, computational results, and their applications in infrastructure restoration and humanitarian logistics. INDS problem extensions are examined, specifically an online optimization framework.

48 - A New Flexible Distribution for Discrete Outcomes

Eugene Hahn, Associate Professor, Salisbury University, 1101 Camden Ave., Salisbury, MD, 21801, United States of America, edhahn@salisbury.edu

A new distribution is introduced for the modeling of discrete outcomes called the tilted beta rectangular binomial distribution. The distribution nests the beta binomial distribution as a special case while allowing greater overdispersion. Preliminary results and modeling applications are presented.

49 - Real Time Optimization of Emergency Response using Social Media Data

Christie Nelson, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, cgrewe@eden.rutgers.edu, William M. Pottenger

During real emergencies, social media data can be leveraged to improve resource allocation and response. Results found from using Higher-Order Topic Modeling on social media data can help to gain valuable insight into what additional resources are needed and where they are needed during an emergency. The Topic Modeling results can then be used as resources in a Linear Programming optimization model. In particular, this project looks at text messages sent during the Haiti 2010 earthquake.

50 - GridPick: A High Density Dynamic Picking System

Onur Uludag, Auburn University, Industrial and System Engineering, Alabama, United States of America, ozu0001@tigermail.auburn.edu

We present a new approach for carton and piece picking operations in the distribution centers. The system has a decentralized control algorithm based on a message-passing protocol in which each cell com- municate with their local neighborhood for the movement of items. In the proposed system, a dynamically changing pick face provides high sku density and low worker travel. Analysis show that introduced sys- tem enables 20% to 50% more picks per unit time compared to a flow rack. We use Petri Nets tool to model system and show structural properties such as deadlock-freeness.

Monday, 1:30pm - 3:00pm

■ MC01

01- West 101- CC

New Relaxation/Convexification Techniques in Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Jiming Peng, University of Illinois at Urbana-Champaign, 801 South Wright Street, Urbana, IL, 61801, United States of America, pengj@illinois.edu

1 - A Nonlinear Semidefinite Relaxation for the Worst-case Linear Optimization under Uncertainties

Tao Zhu, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Room 117, Urbana, Il, 61801, United States of America, taozhu1@illinois.edu, Jiming Peng

In this paper, we consider the so-called worst-case linear optimization (WCLO) with uncertain constraints. Such a problem arises from numerous applications such as systemic risk estimate in finance and stochastic optimization. A tractable nonlinear semidefinite relaxation model is derived. Our preliminary experimental results illustrate that the nonlinear SDR can provide very tight bounds for the original WCLO and is able to locate the exact global solution in most cases.

2 - Solving Nonconvex NLPs and MINLPs with BARON
Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu

We report recent developments in the global optimization software BARON. These include new simultaneous convexification techniques, a convexity detection facility, and new interfaces to a variety of modeling systems. Extensive computational results will be presented.

3 - Nonlinear Semidefite Programming Approach for Quadratically Constrained Quadratic Programming
Jiming Peng, University of Illinois at Urbana-Champaign, 801 South Wright Street, Urbana, IL, 61801, United States of America, pengj@illinois.edu

QCQP is a powerful model that arises from various applications and known to be NP-hard. In this talk, we introduce a new class of approximation algorithms based on nonlinear SDP via integrating semidefinite relaxation and a special kind of penalty method. The new NLSDP can provide tighter bound for QCQP than the standard SDP. A bi-section search algorithm is proposed to solve the NLSDP. The computational complexity of the algorithm is estimated and numerical results will be reported.

4 - Higher-rank Order Semidefinite Cuts for Quadratic and Polynomial Programming Problems
Jitamitra Desai, Assistant professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, Singapore, jdesai@ntu.edu.sg

Given an RLT-based LP relaxation, along with imposing nonnegativity on the RLT product variables, PSD constraints on suitable dyadic variable-product matrices can also be used to derive implied semidefinite cuts. Previously known cuts are generated using coefficient matrices of rank one. Here, we present a cut generation algorithm for higher-rank order semidefinite cuts based on a congruent transformation scheme. Numerical examples will be used to illustrate the proposed cutting plane strategy.

■ MC02

02- West 102 A- CC

Panel Discussion: The Role of Decision Professionals in the Analytics Movement

Sponsor: Decision Analysis

Sponsored Session

Chair: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

1 - The Role of Decison Professionals in the Analytics Movement
Moderator: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com, Panelists: Vince Barabba, Robert Bordley, Don Kleinmuntz

The Analytics Movement is "hot". The movement marries big data and OR to create insight. In this session a panel of DA leaders will address questions, such as: Where does big data and the consultative role of a decision professionl meet? What is new for the decision professional? Is Business Analytics on top of big data naturally focused on near term and optimization of smaller decisions? How do we marry expert judgment with data based analytics?

■ MC03

03- West 102 B- CC

Group Utility, Change, and Multiple Attributes

Sponsor: Decision Analysis

Sponsored Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

1 - A Solution to the Group Decision Problem
Ralph Keeney, Fuqua School of Business, 101 Lombard St., #704W, San Francisco, CA, 94111, United States of America, keeneyr@aol.com

All previous attempts to develop a decision analysis model for group decisions made the implicit assumption that group members had the same decision frame for their joint decision problem. Accounting for member's different frames, a general prescriptive model for group decisions is developed consistent with standard decision analysis assumptions.

2 - An MCDA Approach to Synthetic Route Selection
James Felli, Research Fellow, Eli Lilly and Company, Indianapolis, IN, United States of America, felli_james_c@lilly.com, Peter G. Houghton, Douglas P. Kjell

During the early stages of pharmaceutical process development, development teams need to make synthesis process selections quickly in order to meet demand for clinical trial materials. We will present an MCDA tool we developed to help chemists organize, present and differentiate among key criteria to select a synthetic route to a new active pharmaceutical ingredient.

3 - Valuing Changes in Investment Opportunities
Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

I introduce two new measures for characterizing changes in the valuation of uncertain lotteries when their outcomes are modified by a monotone transformation. The first is a characteristic transformation whose shape determines bounds on the certainty equivalent of the modified lottery. The second is a measure of change whose magnitude determines the change in value of a "small-risk" lottery when its outcomes are modified by a monotone transformation.

4 - State-dependent Hyperbolic Discounting
Casey Lichtendahl, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, lichtendahlc@darden.virginia.edu, Yael Grushka-Cockayne, Daniel Read

We show that background risk and state-dependent choices can accommodate the two aspects of hyperbolic discounting: decreasing impatience and time inconsistency. We apply a multiattribute utility model and find that decreasing impatience and an apparent time inconsistency can arise as a natural consequence of state-dependent dynamic choices. In addition, we show that the same dynamic-programming framework can accommodate hypobolic discounting and other phenomena.

■ MC04

04- West 102 C- CC

Methodological and Applications Issues in MCDM Models

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Adiel Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, 50.630-970, Brazil, almeidaatd@gmail.com

1 - A MCDM Model for Popular Demands Priority Classification: The Campina Grande City Council Participatory
Adiel Almeida-Filho, Assistant Professor, UFPE, Cx Postal 7471, Recife, PE, 50.630-971, Brazil, atalmeidafilho@yahoo.com.br, Mayne Almeida

This work presents a model and a case study for one of the stages of Campina Grande City Council participatory budget. In this work was considered the first stage of the process where popular demands are obtained from the population. The proposed model deals with the secretary leve,l considering the government programs and government strategy, classifying the population requests (alternatives) into three priority classes through Promsort method.

2 - Decision Support System for Qualitative Intra-criteria Evaluation
Danielle Morais, Assistant Professor, Federal University of Pernambuco, R. Cons. Portela, 169/701., Recife, PE, 52020-030, Brazil, daniellemorais@yahoo.com.br, Adiel Almeida

In multicriteria problems, decision-makers (DM) normally feel difficult to evaluate alternatives under qualitative criteria. Commonly, the elicitation process uses a fixed nominal scale. This paper presents a decision support system which performs a 'playing cards' procedure, facilitating to rank alternatives and also introducing a cardinal notion. The system allows quantify the alternatives based on their rank position, without requires a fixed scale size.

3 - A Multicriteria Decision Model to Support Public Safety Planning
Caroline Mota, Assistant Professor, Universidade Federal de Pernambuco, Av. Prof. Morais Ramos s/n, Recife, Brazil, carol3m@gmail.com, Andrè Gurgel

Public safety planning is a subject of great interest in the modern society. This article proposes a multicriteria decision model that seeks to prioritize areas for a given region using demographic and socioeconomic issues. Consequently, it's possible to perform different strategies in a region according to a set of factors that can influence criminality. The model was applied in Brazilian city.

4 - MCDM Models in Project Portfolio Selection
Adiel Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, 50.630-970, Brazil, almeidaatd@gmail.com

Selection of Project portfolio based on multicriteria decision making (MCDM) methods is analyzed. MCDM compensatory and non-compensatory methods are considered, with emphasis to outranking and additive methods. Problems related to scales used for intra-criteria evaluation are considered. Considerations are given to applications on Research and Development (R&D) project portfolio selection.

■ MC05

05- West 103 A- CC

Joint Session QSR/DM: Predictive Analytics Applications II

Sponsor: Quality, Statistics and Reliability & Data Mining

Sponsored Session

Chair: Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, United States of America, paul.goethals@usma.edu

1 - The Effect of the Three-Point Shot on the Game of Basketball
Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, United States of America, paul.goethals@usma.edu, Tina Hartley

In the 1979-1980 and 1986-1987 basketball seasons for the National Basketball Association and the National Collegiate Athletic Association, respectively, the three-point shot rule was enacted. The rule enables teams to receive three-points, rather than two, for each shot made beyond a designated arc surrounding the basket. This research examines the effect of this rule on the game of basketball at both the professional and collegiate-levels, using statistical analyses of trends in performance.

2 - Development of a Quality Evaluation Scheme for Smartphone Product Service Systems
Hyun-Jin Kim, Pohang University of Science and Technology, Nam-Gu Hyoja-Dong San 31, Pohang, Korea, Republic of, hj_kim@postech.ac.kr, Kwang-Jae Kim

A combination of smartphone hardware and its related services is a representative case of product service systems (PSS). In addition to the hardware, the services, which provide users with various contents by web or applications, are major sources of customer satisfaction. Hence, when evaluating quality of smartphone, the quality of its related services should be considered. In this talk, we present a scheme for evaluating the quality of smartphone PSS.

3 - Expanding an Expected Goals Model for Evaulating NHL Teams and Players
Nicholas Clark, Instructor, Math Department USMA, Thayer Hall, West Point, NY, 10996, United States of America, nicholas.clark@usma.edu, Derek Burt, Brian Macdonald, Michael Findlay

One difficulty with analyzing performance in hockey is the relatively low scoring rate. In this paper, we predict goals using non-traditional regression techniques. Our models outperform other models used in the sport with regard to L2 norm between actual goals vs predicted goals. We estimate a player's contribution to his team's expected goals per 60 minutes. The results for expected goals provide an additional means by which NHL analysts can measure how valuable a player is to his team.

4 - Realignment in the NHL as a Quadratic Assignment Problem
Brian Macdonald, Assistant Professor, Math Department USMA, Thayer Hall, West Point, NY, 10996, United States of America, brian.macdonald@usma.edu, William Pulleyblank

The NHL has been planning realignment since the Atlanta Thrashers moved to Winnipeg, becoming the Jets. The Jets remained in the Southeast Division, creating an excessive amount of travel for those teams. We ask the question: Which teams should be in which divisions in order to minimize a weighted sum of the distances between each pair of cities? This optimization problem can be framed as a quadratic assignment problem. We report on "good" league structures under a variety of conditions.

■ MC06

06- West 103 B- CC

Joint Session Sim/QSR: Design of Experiments and Statistical Analysis for Simulation

Sponsor: Simulation & Quality, Statistics and Reliability

Sponsored Session

Chair: Feng Yang, Assistant Professor, West Virginia University, P.O. Box 6070, Morgantown, WV, 26506, United States of America, feng.yang@mail.wvu.edu

Co-Chair: Hong Wan, Associate Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, hwan@purdue.edu

1 - Quoting Customer Lead Time via Simulation-based Statistical Methods
Minqi Li, PhD Student, West Virginia University, 777 Chestnut Ridge Road, Morgantown, WV, 26505, United States of America, mli6@mix.wvu.edu, John Fowler, Feng Yang, Hong Wan

A comprehensive framework is developed to model the lead time distribution of a new order as a function of the shop status characteristics. An experimental design methodology is developed to investigate the dependence of lead time upon a complete and non-redundant set of shop status factors. Statistical models are estimated from well-designed simulation experiments for lead time quotation.

2 - Sliced Full Factorial-based LHDs as a Framework for a Batch Sequential Design Algorithm
Weitao Duan, Graduate Student, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, WeitaoDuan2013@u.northwestern.edu, Bruce Ankenman

Sequential design strategies allow experimenters to collect data only until prediction precision is sufficient. We present a batch sequential experiment design algorithm that is based on sliced Full Factorial-Based Latin Hypercube Designs, an extension OA-based LHDs. The structure of the FF-based LHD produces good projectivity and orthogonality throughout the stages of the design. We then demonstrate the sampling and fitting properties through both empirical studies and theoretical arguments.

3 - Using Discrete Optimization via Simulation to Improve Semiconductor Manufacturing Production Planning
Jie Xu, Assistant Professor, George Mason University, 4400 University Dr, MS 4A6, GMU Engr Bldg RM2100, Fairfax, VA, 22030, United States of America, jxu13@gmu.edu, Feng Yang

Production planning is a very challenging problem in a semiconductor manufacturing system due to the variability in the manufacturing system and the uncertainty in demand. No existing analytic model can realistically capture both effects and design an optimal production plan accordingly. We propose to use a discrete-event simulation model to realistically describe the variability and uncertainty and develop an optimization via simulation algorithm to solve the production planning problem.

4 - The Incentive Effect of Acceptance Sampling Plans in a Supply Chain with Endogenous Product Quality
Tian Ni, PhD Student, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ni10@purdue.edu, Hong Wan, Xiaowei Xu

This paper studies a firm that procures a product from a supplier with endogenous product quality. The firm determines the acceptance sampling plan and the supplier determines the quality effort level in either a simultaneous or a Stackelberg leadership game. We identify the Nash equilibriums, and show the firm's and the supplier's optimal strategies are sensitive to both the recall loss sharing ratio and the game format.

■ MC07

07- West 104 A- CC

Machine Learning II

Sponsor: Data Mining

Sponsored Session

Chair: Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu

1 - Analyzing the Effect of Comorbidities on Delay in Discharge among Breast Cancer Inpatients

Shengfan Zhang, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, shengfan@mail.uark.edu, Hui Wang, Wei Bao

It is estimated that by 2030, there will be more than 70 million persons 65 years and older in the U.S., which is expected to be approximately 19% of the population by then. When admitted to a hospital, older patients usually have more than one comorbid conditions in addition to their primary diagnosis. This study seeks to explore the effect of comorbidities on the discrepancies between actual hospitalization charges and the Medicare reimbursement rates among breast cancer inpatients.

2 - Relaxed Support Vector Machines and Extensions

Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu

Relaxed support vector machines (RSVM) are variations of support vector machines, which feature a restricted budget for penalty-free slack, which is usually consumed by samples that would otherwise incur high penalty. RSVM have previously been proposed for binary classification and multiple instance classification. We propose extensions of RSVM to one-class and multi-class cases, and to support vector regression. We compare results on synthetic data and public benchmark datasets.

3 - Empirical Dynamic Complex Network Model of Genetic Expression Processes

Hoang Tran, Oklahoma State University, 322 Engineering North, Stillwater, OK, United States of America, hoangmt@ostatemail.okstate.edu, Satish Bukkapatnam

Abstract In this paper, we present an approach to reconstruct the nonlinear dynamics of a complex network from a high-dimensional vector time-series based on causality analysis. It overcomes the challenges associated with sparse time samples, large parameter space, and the need for accurate priors with previous Bayesian network models. Our method is applied to study the data set on genetic expression of Drosophila melanogaster using a sequence of DNA microarray data.

■ MC08

08- West 104 B- CC

Nonprofit Supply Chains

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Gemma Berenguer, Purdue University, Krannert School of Management, West Lafayette, IN, United States of America, gemmabf@purdue.edu

1 - Nonprofit Supply Chain Design: The Solar Cooking Case

Gemma Berenguer, Purdue University, Krannert School of Management, West Lafayette, IN, United States of America, gemmabf@purdue.edu, Z. Max Shen

The research community is paying increasing attention to the analysis of nonprofit practices that can differ from for-profit ones. In this talk we discuss the particularities of the private nonprofit organization (NPO) and, by extension, its supply chain. We illustrate this analysis with a case study of an NPO that introduces solar cooking to low-income countries with the objectives of improving social, economic, and environmental conditions. We focus on this NPO's supply chain design problems.

2 - The Effect of Earmarked Funding on Fleet Management for Relief and Development

Maria Besiou, Kuehne Logistics University-THE KLU, Brooktorkai 20, Hamburg, 20457, Germany, Maria.Besiou@the-klu.org, Luk Van Wassenhove, Alfonso Pedraza Martinez

International Humanitarian Organizations (IHO) often implement relief and development programs simultaneously, their operations can be decentralized and their funding can be earmarked. Using system dynamics we find that due to the interaction of dual mission and earmarked funding, a system with local procurement and a short lead time may consistently take longer to supply transportation for disaster response than a system with global procurement and high lead time.

3 - Multiproduct Humanitarian Healthcare Supply Chains: A Network Modeling and Computational Framework

Min Yu, University of Portland, 5000 N Willamette Blvd., Portland, OR, 97203, United States of America, myu@som.umass.edu, Anna Nagurney, Patrick Qiang

We develop a model for supply chain network design/redesign in the case of multiple products, with particular relevance to humanitarian healthcare. The model can be utilized for the determination of the optimal allocation of resources for multiple vaccine and medicine production, storage, and distribution to points of need in the case of disasters or epidemics. It may also be used by organizations to quantify the humanitarian healthcare supply chain costs in a transparent way to stakeholders.

4 - Fleet Management Coordination in Decentralized Humanitarian Operations

Alfonso Pedraza Martinez, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, alpedraz@indiana.edu, Sameer Hasija, Luk Van Wassenhove

Motivated by extensive field research we study incentive alignment to coordinate humanitarian operations. In large international humanitarian organizations efficiency/equity balancing headquarters assign operational capacity to equity-oriented programs. This creates a misalignment of incentives complicated by earmarked funding of vehicles. We propose an operational mechanism design for system coordination.

■ MC09

09- West 105 A- CC

Behavioral Issues in MCDM

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Hannele Wallenius, Professor, Aalto University, Otaniementie 17, Espoo, Finland, hannele.wallenius@aalto.fi

1 - Can A Linear Value Function Explain Choices? An Experimental Study

Jyrki Wallenius, Professor, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, jyrki.wallenius@aalto.fi, Pekka Korhonen, Kari Silvennoinen, Anssi Öörni

We investigate in a simple bi-criteria experimental study, whether subjects are consistent with a linear value function while making binary choices. Many inconsistencies appeared in our experiment. However, the impact of inconsistencies on the linearity vs. non-linearity of the value function was minor. Moreover, a linear value function seems to predict choices for bi-criteria problems quite well. This ability to predict is independent of whether the value function is diagnosed linear or not.

2 - Constructing a Strict Total Order for Alternatives Characterized by Multiple Criteria

Akram Dehnokhalaji, Assistant Professor, Kharazmi University (Tehran) and Aalto University School of Economics, Department of Mathematics, Tehran, Iran, akramdehnokhalaji@gmail.com, Pekka Korhonen, Murat Köksalan, Jyrki Wallenius, Nasim Nasrabadi

The problem of finding a strict total order for a finite set of multiple criteria alternatives is considered. We extend previous work by us to find a partial order for a finite set of alternatives. The preference information from the preference cones and polyhedral sets and pairwise comparisons yields a preference matrix. The resulting binary relation may not be transitive. We construct an integer programming model resulting a strict total order to rank alternatives.

3 - A Careful Look at Criterion Importance and Weights
Pekka Korhonen, Professor, Aalto University, School of Economics, Helsinki, 00100, Finland, pekka.korhonen@aalto.fi, Jyrki Wallenius, Kari Silvennoinen, Anssi Öörni

We study the connection between announced importance of criteria and weights, when a linear value function is assumed to represent DM's preferences. Based on an experimental setting, we use the subjects' responses to estimate the weights for the criteria in the linear value function. The value function explains choices very well, but our results imply that there is a reason to question the common belief that the values of the weights would reflect the importance of criteria.

4 - Consumer Preferences for Sustainability and their Impact on SCM: The Case of Mobile Phones
Markku Kuula, Professor, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, Finland, markku.kuula@aalto.fi, Anu Bask, Merja Halme, Markku Kallio

The consumers are interested in sustainable development. In the case of mobile phones we identify and assess the value of relevant product features related to sustainability in supply chains. Focus-group discussions identified the potential attributes that might affect the product choice. Choice-based conjoint analysis was used to assess the importance of the attributes. We found that, there are consumers who are willing to pay a premium for features that promote sustainable development.

■ MC10

10- West 105 B- CC

Advances in Stochastic and Robust Utility Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States of America, mehrotra@iems.northwestern.edu

1 - New Results in Scenario Generation for Stochastic Optimization Problems via the Sparse Grid Method
David Papp, Postdoctoral Fellow, Northwestern University, IE/MS, 2145 Sheridan Rd C210, Evanston, IL, 60208, United States of America, dpapp@iems.northwestern.edu, Sanjay Mehrotra, Shenyuan Chen

We present a sparse grid method for scenario generation when the uncertainty is modeled using a continuous multivariate distribution. The sequence of optimal solutions of the approximations converges to the true optimum. An improvement is presented when the uncertainty is given by a linear transform of a product of univariate distributions. Experiments show that the sparse grid method is very efficient for smooth integrands, and that it is potentially scalable to thousands of random variables.

2 - Robust Sparse Regression and Orthogonal Matching Pursuit
Yudong Chen, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, ydchen@utexas.edu

We consider support recovery in sparse regression, when a subset of the covariate/response pairs is arbitrarily corrupted. All existing tractable methods fail to provide any guarantees. Surprisingly, the natural brute force algorithm is also remarkably poor. In contrast, we provide a simple algorithm that gives stronger performance guarantees. Moreover, we compare our formulation with robust optimization, and demonstrate interesting connection and difference between them.

3 - Robust Decision Making using a Risk-averse Utility Set
Jian Hu, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Rd., IMSE Department, Dearborn, MI, 48128, United States of America, jianhu2010@u.northwestern.edu, Sanjay Mehrotra

We develop a flexible decision making framework using the concept of utility robustness to address the problem of ambiguity and inconsistency in utility assessments. Boundary and auxiliary conditions are used to describe a utility set that characterizes a decision maker's risk attitude. Reformulation and convergence results are given for the discrete and continuous specifications of the utility set. A portfolio investment decision problem is used to illustrate the basic ideas.

4 - Robust Decision Making using a General Utility Set
Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States of America, mehrotra@iems.northwestern.edu, Jian Hu

A robust decision-making framework is built on a general utility set which characterizes a decision maker's risk attitude described by certain boundary and auxiliary conditions. This framework is studied using the Sample Average Approximation (SAA) approach. We shows the asymptomatic convergence and give a mixed-integer reformulation. An application of this framework is illustrated using a portfolio investment decision problem.

■ MC11

11- West 105 C- CC

Robust Optimization and Applications

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Muhong Zhang, Assistant Professor, Arizona State University, 699 S. Mill Ave., Brickyard Engineering (BYENG) 553, Tempe, AZ, 85281, United States of America, Muhong.Zhang@asu.edu

1 - Robust Optimization Method for Combined Chemo/Radiation Treatment Planning
Omid Nohadani, Assistant Professor, Purdue University, 315 N. Grant, West Lafayette, IN, 47907, United States of America, nohadani@purdue.edu

The treatment of cancerous tumors with external radiation is planned based on initial data and independent of other modalities, resulting in strategies that do not vary over the course of the treatment. However, the sensitivity of the tissue to radiation changes over time, particularly when chemotherapeutic agents are combined. Based on clinical cases, we demonstrate that robust plans account for temporal changes and are intrinsically insensitive to deviations from the assumed temporal path.

2 - Two-stage Minimax Regret Robust Uncapacitated Lot-Sizing
Muhong Zhang, Assistant Professor, Arizona State University, 699 S. Mill Ave., Brickyard Engineering (BYENG) 553, Tempe, AZ, 85281, United States of America, Muhong.Zhang@asu.edu

In this talk, we consider the two-stage minimax robust uncapacitated lot-sizing problem with interval uncertain demands. A mixed integer programming formulation is proposed. Even though the robust uncapacitated lot-sizing problem with discrete scenarios is an NP-hard problem, we show that it is polynomial solvable under the interval uncertain demand set.

3 - Routing Optimization with Deadlines under Uncertainty
Jin Qi, National University of Singapore, Mochtar Riady Building, BIZ1-8-76, 15 Kent Ridge Drive, Singapore 119245, Singapore, qijin@nus.edu.sg, Melvyn Sim, Patrick Jaillet

We study a routing problem with deadlines imposed at a given subset of nodes, and uncertain arc travel times characterized by distributional information set. By introducing a new measure named Lateness Index to evaluate the performance of meeting deadlines, we show that the special case, in which only one node has a deadline requirement, is polynomially solvable. Moreover, for the general case, we could find exact optimal routing policy by only solving a series of deterministic routing problems.

■ MC12

12- West 106 A- CC

Convex Relaxations for Mixed-integer Nonlinear Programs

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: James Luedtke, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, jrluedt1@wisc.edu

1 - Stronger Relaxations using Optimality Constraints for Global Optimization of Unconstrained NLPs
Yash Puranik, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ypp@andrew.cmu.edu, Nick Sahinidis

We discuss a methodology for obtaining tighter convex relations using first order optimality conditions, in the context of the lower bounding step for a spatial branch and bound framework for global optimization. We demonstrate a speed up in convergence in a test set of 200 problems using our framework

2 - New Linearization Strategies for Mixed Integer Nonlinear Programs

Mahdi Hamzeei, Research Assistant, University of Wisconsin-Madison, 3241 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hamzeei@wisc.edu, James Luedtke

We introduce new strategies to add linearizations in linearization-based algorithms to MINLPs where only the convexity of feasible region is assumed. Existing algorithms derive linearizations over the solution of certain sub-problems. We show how, using line-search methods, we obtain other points to take more efficient linearizations. Furthermore, we investigate using other sub-problems. Finally in numerical results, we compare the performance of new strategies against the existing algorithms.

3 - A Branch-and-Cut Algorithm for Convex MINLPs

Serdar Yildiz, PhD Candidate, Lehigh University, 200 West Packer Ave., Bethlehem, PA, 18015, United States of America, sey309@Lehigh.edu, Ashutosh Mahajan

We present a branch-and-cut algorithm for solving convex mixed-integer nonlinear optimization (MINLP) problems. In contrast to the linearization-based approach of adding cutting planes to a linear relaxation of the MINLP, we add cuts directly to the continuous nonlinear-relaxation. We describe methods used to derive cuts from special combinatorial structures and nonlinear functions. Results obtained from computational experiments performed using the open source MINOTAUR toolkit are presented.

4 - Lifted Cuts for Box Constrained Quadratic Programming with Indicators

Hongbo Dong, Postdoc, University of Wisconsin-Madison, 330 North Orchard Street, Madison, WI, 53705, United States of America, hdong6@wisc.edu, Jeff Linderoth, Hyemin Jeon

We study the box constrained quadratic programs with binary indicators that act as "on/off" switch for each continuous variable. This structure appears in many MINLPs. We show how PSD cuts for box constrained quadratic programs can be lifted to include binary indicators. Further we show the separation problem for the related class of lifted concave QPB cuts can be solved via Semidefinite Programming. Finally we explore strategies to use these cuts in practice.

■ MC13

13- West 106 B- CC

Advanced Methods in Linear Programming

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Dan Li, Lehigh University, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, dal207@Lehigh.EDU

1 - The Duality between the Perceptron Algorithm and the von Neumann Algorithm

Dan Li, Lehigh University, 200 West Packer Ave., Bethlehem, PA, 18015, United States of America, dal207@Lehigh.EDU, Tamás Terlaky

We investigate and reveal the duality relationship between the perceptron and the von Neumann algorithms. We interpret variants of the perceptron algorithm as variants of the von Neumann algorithm, and vice-versa; as well as transit the complexity results from one family to the other. Further, an Approximate Farkas Lemma enables us to derive bounds for the distance to the feasibility or infeasibility from approximate solutions of the alternative systems.

2 - A Smooth Perceptron - von Neumann Algorithm

Negar Soheili, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, nsoheili@andrew.cmu.edu, Javier Pena

The perceptron and von Neumann algorithms for solving linear programming feasibility problems have attracted attention due to their simplicity and popularity in machine learning. A major limitation of these algorithms is that they exhibit slow convergence. We overcome this limitation by developing a procedure that combines smooth versions of these algorithms and retains their original simplicity. Further, we generalize it to solve conic systems.

3 - Sparse Grid Interpolation in Linear Programming

Emanuele Borgonovo, Professor, Bocconi University, Via Roentgen 1, Milan, Italy, emanuele.borgonovo@unibocconi.it, Richard Wendell, Greg Buzzard

In this work, we propose the utilization of sparse grid interpolation in linear programming. We show that this approach, when coupled with functional ANOVA, allows decision-makers to broaden the range of managerial insights obtained by sensitivity analysis. The connection with the tolerance sensitivity approach is discussed.

■ MC14

14- West 106 C- CC

Modern Scheduling Applications and Theory

Cluster: Scheduling and Project Management

Invited Session

Chair: Marc Posner, Professor, Ohio State University, Integrated Systems Eng., 1971 Neil Avenue, Columbus, OH, 43210, United States of America, posner.1@osu.edu

1 - Dynamic Programming Based Mechanism for Energy Aware Scheduling

Rodrigo Carrasco, Columbia University, 500 West 120th Street, 313A S. W. Mudd Building, New York City, NY, 10027, United States of America, rac2159@columbia.edu, Garud Iyengar, Cliff Stein

Controlling power consumption in the context of scheduling is fast becoming a very important research problem. Here we present new dynamic programming based mechanisms for energy aware scheduling in which our objective is to minimize the sum of the total weighted completion time and the total energy consumption of the jobs processed.

2 - Scheduling Cluster Tools in Semiconductor Manufacturing

Emrah Cimren, Industrial Engineer, Micron Technology, 9600 Godwin Drive, Manassas, VA, 20110, United States of America, ecimren@micron.com, Marc Posner, DJ Kim

Cluster tools, which consist of several processing modules and transport robots, are one of the expensive equipments used in semiconductor manufacturing. We develop a methodology to determine optimal schedules for cluster tools. The proposed approach provides route of products in the tool with the minimum cycle time. We provide properties of optimal solution and a characterization of the optimal schedule. Computational results show the effectiveness of the methodology in practice.

3 - Online Production Planning and Information Purchase to Maximize On-Time Orders

Nicholas Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, hall.33@osu.edu, Chris Potts, Marc Posner

We consider a two period production planning problem. In the first period full information is known; new orders are available in the second period. The objective is to maximize the proportion of on-time orders. We describe an efficient algorithm with asymptotically best possible performance that depends on the relative period lengths. We study the sensitivity of performance to the decision maker's choices. We describe an algorithm that makes asymptotically optimal use of purchased information.

4 - Parallel Machine Scheduling to Minimize Overtime and Waste Costs

Nickolas Freeman, PhD Student, University of Alabama, Box 870226, Tuscaloosa, AL, United States of America, nkfreeman@cba.ua.edu, John Mittenthal, Sharif Melouk

We consider a parallel machine scheduling problem with sequence dependent setup times and costs, where production waste and processing times depend on machine assignments. We use an MIP formulation to minimize overtime and waste costs which captures trade-offs between these cost components. We also develop two heuristic solution approaches and bounds on their solution quality. Experiments show our approach outperforms more traditional scheduling objectives with respect to the costs considered.

■ MC15

15- West 202- CC

Software Demonstration

Invited Session

1 - FICO- Clear and Simple High Performance Technical Computing with Julia

Oliver Bastert, FICO, Starley Way, Birmingham, United Kingdom, OliverBastert@fico.com

Julia is a new, high-performance dynamic programming language for technical computing that provides a sophisticated compiler, distributed parallel execution, numerical accuracy and an extensive mathematical function library. Forio will demo its IDE for Julia that allows users to read, write, edit and execute their Julia code and includes syntax-highlighting and code-completion.

2 - Imagine That, Inc.- ExtendSim Simulation Software
Dave Krahl, Technology Evangelist, Imagine That, Inc., 6830 Via Del Oro, #230, San Jose CA 95119, United States of America, davek@extendsim.com

Experience for yourself the ease of use, flexibility, and power of a professional simulation tool – ExtendSim. Use custom interactive model interfaces and hierarchical submodels to rapidly explore simulation concepts and design options. Realize why ExtendSim is the power tool of choice in the simulation industry. Don't miss this demo!

■ MC16

16- West 207- CC

Regenerative Medicine Manufacturing– A Systems Engineering Perspective

Cluster: Tutorials

Invited Session

Chair: Richard A. Wysk, Dopaco Distinguished Professor, North Carolina State University, Department of ISE, Raleigh, NC, United States of America, rawysk@ncsu.edu

1 - Regenerative Medicine Manufacturing– A Systems Engineering Perspective
Richard A. Wysk, Dopaco Distinguished Professor, North Carolina State University, Department of ISE, Raleigh, NC, United States of America, rawysk@ncsu.edu, Molly Purser, Paul Cohen, Rohan Shirwaiker, Ola Harrysson

This tutorial introduces the basic concepts associated with a regenerative medicine manufacturing (RMM) system. A background of regenerative medicine, the critical factors involved in its scale-up translation, and an overview of a systems engineering approach for RMM system design are presented.

■ MC17

17- West 208 B- CC

Mentoring Undergraduate Research

Sponsor: INFORM-ED

Sponsored Session

Chair: Janet McLeavey, Professor, United States Coast Guard Academy, 15 Mohegan Ave, New London, CT, 06320, United States of America, Janet.A.McLeavey@uscga.edu

1 - Managing Student Collaboration on Multi-disciplinary Projects
Melinda McGurer, Captain, U.S. Coast Guard Academy, 15 Mohegan Ave., New London, CT, 06320, United States of America, Melinda.D.McGurer@uscg.mil, Katherine B. Krystinik, Ian D. Frommer

A discussion of ideas and methods for approaching the incorporation of students from different disciplines on research projects with examples from Operations Research / Government and Operations Research / Engineering. An ideal outcome of an interdisciplinary project is that students learn about a field other than their own, and how the disciplines interact. In so doing, they gain a deeper understanding of their own discipline. How can this outcome be fostered? Should each discipline have pipeline work that feeds into the overarching structure of the project? Is it effective to blend the inter-disciplinary work throughout the project? How do we develop and encourage all members of the team to feel a sense of ownership in their roles as team members and leaders as they perform different aspects of the research?

2 - What are the Expected Outcomes of Undergraduate Research and/or Consulting Project?
Janet McLeavey, Professor, United States Coast Guard Academy, 15 Mohegan Ave., New London, CT, 06320, United States of America, Janet.A.McLeavey@uscga.edu

Should students be expected to produce results that will be useful to the sponsor? Should results affect grades? Or, is this an opportunity to explore different techniques even if they prove ineffective? Will this affect willingness of sponsors to participate? Will this affect the reputation of the mentor and/or department? How does a mentor weight the importance of students' confidence while still helping them to construct an approach that gives them a sense of accomplishment?

3 - Incorporating Undergraduates in Multidisciplinary Research Teams
Amy Cohn, University of Michigan, Ann Arbor, MI, United States of America, amycohn@umich.edu

One of the key challenges of training undergraduate engineering students is to prepare them for facing open-ended problems. Another challenge is to train them to communicate with non-engineers. We discuss our work with research teams that combine engineering undergraduates with medical students, residents, and clinicians.

■ MC18

18- West 208 A- CC

Copula and Kriging Techniques

Contributed Session

Chair: Ning Zhang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, ningzhang@u.northwestern.edu

1 - Copula based Synthetic Population Generation
Byungduk Jeong, PhD Candidate, KAIST, 291 Daehar-ro, Yuseong-gu, Daejeon, Korea, Republic of, jbd@kaist.ac.kr, Hayong Shin, Deok-Soo Kim, Won Jun Lee

Generating synthetic populations is a fundamental step of agent based microsimulations. The iterative proportional fitting (IPF) has been widely used to create the joint distribution of individuals by fitting the reference joint distribution to the target margins. In this paper, a novel method is proposed based on the copula concept. In most test cases, the proposed method performed significantly better in preserving the dependence structure of the reference joint distribution.

2 - Efficient Experimental Design for Kriging's Use in Simulation Metamodeling
Michael Hosking, North Carolina State University, 436 Summerwalk Circle, Chapel Hill, NC, 27517, United States of America, mrhoskin@ncsu.edu

One of the techniques for simulation metamodeling which has recently come into favor is Kriging. However, OR problems frequently have much higher dimension than those in spatial statistics (Kriging's origin). The prior research into efficient experimental design for Kriging focuses on 1, 2 or 3 dimensional situations. I will present some of the past work in efficient design with emphasis on higher dimensional results and present my own findings using a test bed of OR specific problems.

3 - Filtered Brownian Fields for Engineering Response Surface Metamodeling
Ning Zhang, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, ningzhang@u.northwestern.edu, Daniel Apley

In kriging-based metamodeling of computer simulations, a stationary Gaussian process is the most common choice of underlying random field model. Despite its popularity, this choice of model has several undesirable characteristics when used for engineering response surface metamodeling. We investigate filtered Brownian fields, a form of non-stationary Gaussian process, as an alternative random field model and show that they are overall very attractive models.

■ MC19

19- West 211 A- CC

Optimization Society Prizes

Sponsor: Optimization

Sponsored Session

Chair: Jon Lee, University of Michigan, IOE Department, 1205 Beal Ave, Ann Arbor, MI, United States of America, jonxlee@umich.edu

1 - Optimization Society Student Paper Prize
Katya Scheinberg, Associate Professor, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, katyas@lehigh.edu

The INFORMS Optimization Society Student Paper Prize was established in 2006 and is awarded annually at the INFORMS Fall National Meeting to one or more student(s) for an outstanding paper in optimization that is submitted to and received or published in a refereed professional journal during the three calendar years preceding the year of the award. The prize serves as an esteemed recognition of promising students who are looking for an academic or industrial career.

2 - The INFORMS Optimization Society Prize for Young Researchers

Endre Boros, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, Endre.Boros@rutcor.rutgers.edu

The INFORMS Optimization Society Prize for Young Researchers was established in 1998 and is awarded annually to one or more young researcher(s) for an outstanding paper in optimization that was accepted, or published in a refereed professional journal within the last four years. All authors must have been awarded their terminal degree within the last eight years. The prize serves as an esteemed recognition of promising colleagues who are at the beginning of their career.

3 - The Farkas Prize of the INFORMS Optimization Society

David Shmoys, Cornell University, 231 Rhodes Hall, Ithaca, NY, United States of America, shmoys@cs.cornell.edu

The Farkas Prize of the INFORMS Optimization Society was established in 2006 and is awarded annually at the INFORMS Fall National Meeting to a mid-career researcher for outstanding contributions to the field of optimization, over the course of their career. Such contributions could include papers (published or submitted and accepted), books, monographs, and software. The awardee will be within 25 years of their terminal degree as of January 1 of the year of the award. The prize serves as an esteemed recognition of colleagues in the middle of their career.

4 - The Khachiyan Prize for Lifetime Accomplishments in Optimization

Kurt Anstreicher, Professor, University of Iowa, Department of Management Sciences, S210 PBB, Iowa City, IA, 52242, United States of America, kurt-anstreicher@uiowa.edu

The Khachiyan Prize of the INFORMS Optimization Society was established in 2010 and is awarded annually at the INFORMS Fall National Meeting to an individual or a team for life-time achievements in the area of optimization. The award recognizes a sustained career of scholarship from nominees who are still active at the year of the nomination. The prize serves as an esteemed recognition of innovativeness and impact in the area of optimization, including theory and applications.

■ MC20

20- West 211 B- CC

Lean in Health Care

Contributed Session

Chair: Yang Sun, Assistant Professor and Liaison, Decision Sciences, California State University, Sacramento, College of Business, 6000 J St, Sacramento, CA, United States of America, suny@csus.edu

1 - Optimal Levels of Standardization in Professional Organizations?- Evidence from German Hospitals

Roman Mennicken, RWI, Essen, Essen, Germany, roman.mennicken@rwi-essen.de, Desdemona Möller, Ludwig Kuntz

We discuss the non-linear structure of the impact of standardization on service quality in hospitals. We derive our hypotheses by combining operations management and a human behavioral perspective. We empirically test the hypotheses using a mortality-sensitive patient population.

2 - Empirical Study of Business Process Management and Applications in Healthcare Systems

He Zhang, PhD Candidate, & Management Sciences, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, hezhang2012@u.northwestern.edu, David Liebovitz, Bradley Malin, Carl Gunter, Sanjay Mehrotra

Business process management is to use methods and techniques to support the administration and analysis of business processes. In this paper, we introduce an large data set of event logs from an hospital and show how to empirically construct a business process model. We further use this process model to study access control problem in healthcare systems.

3 - Clinical Quality, Experiential Quality and Financial Performance: Are All Hospitals Equal?

Claire Senot, The Ohio State University, Fisher Hall 600, 2100 Neil Avenue, Columbus, OH, United States of America, senot.1@osu.edu, Aravind Chandrasekaran, Peter Ward, Anita Tucker

Hospitals are expected to deliver high levels of clinical quality (i.e. follow standardized guidelines) and experiential quality (i.e. customize care to the individual patient) in each interaction with the patient. We expose the challenges and investigate the financial benefits of this dual focus for hospitals. Findings show that, despite improving experiential quality being a challenge for small hospitals, combining clinical and experiential quality leads to superior financial performance.

4 - The Impact of Lean Principles Implementation on Quality and Efficiency of US Hospitals

Yong Taek Min, PhD Candidate, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, United States of America, ytmin@bu.edu, Joseph Restuccia, Michael Shwartz, Jay Kim

Utilizing the data from a survey of 470 hospitals on quality improvement activity and another data set from the Center for Medicare & Medicaid Services, we empirically evaluate the extent of lean principles implementation in US hospitals and its impact on healthcare efficiency and quality. Preliminary analysis shows there is significant correlation between lean implementation and healthcare efficiency and quality.

5 - Reengineering a Service Process at a Medical Diagnostic Center

Yang Sun, Assistant Professor and Liaison, Decision Sciences, California State University, Sacramento, College of Business, 6000 J St., Sacramento, CA, United States of America, suny@csus.edu

The healthcare industry has faced continuous demand growth in recent years. A DMAIC procedure was followed to help a major medical diagnostic facility streamline its front-end, labor intensive process. Simulation models were used to show potential improvements in on-time delivery as well as savings on operational cost under higher demand. The facility was remodeled and results have shown actual improvements in operational performances.

■ MC21

21- West 212 A- CC

Network Optimization II

Sponsor: Optimization/Networks

Sponsored Session

Chair: Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu

1 - The TSP Race Problem

Bahar Cavdar, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, baharca@gatech.edu, Joel Sokol

A traveling salesman is given a set of cities to visit. How long does it take to complete his tour, from the time he gets the data to the time he returns home? That depends not only on travel time, but also on how long it takes him to compute his route. We study the TSP Race problem, where it is sometimes optimal to sacrifice tour minimization in order to decrease decision time.

2 - Algorithms for a Multicommodity Network Flow Problem having Node Reliability Considerations

Bita Tadayon, Research Assistant, University of Florida, 406 Weil Hall, University of Florida, Gainesville, FL, 32608, United States of America, bitanhj@ufl.edu, J. Cole Smith

We consider the problem of sending a set of messages from origin to destination nodes via intermediate hubs. Given the amount of demand between each origin-destination pair, the problem is to find minimum-cost paths to transmit all messages while assuring that each message is relayed with a sufficiently large probability. This probability depends on the reliability of hubs on the message path, and those reliabilities are functions of the amount of information flow across the hub.

3 - Extreme Tornados

Paul Brooks, Assistant Professor, Department of Statistical Sciences and Operations Research, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23284, United States of America, jpbrooks@vcu.edu

Konig's Theorem states that in a bipartite graph, the covering number equals the matching number. Ryser's conjecture asserts that for r-partite hypergraphs, the covering number is at most r-1 times the matching number. The conjecture is open for intersecting hypergraphs. An intersecting hypergraph with covering number r-1 must contain a structure called a tornado. Properties of extreme tornados, those with covering number r-1, are described.

4 - Geographical Interdiction of a Maximum Flow Network
Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu, J. Cole Smith

We consider a network that resides in Euclidean space and a defender whose goal is to maximize flow from a source node to a sink node in the network. The problem we examine takes the perspective of an attacker, who seeks to minimize the defender's maximum flow by locating attacks in the area surrounding the network. We develop a solution approach based on solving a sequence of lower-bounding integer programs and demonstrate the efficacy of our approach on a set of test instances.

■ MC22

22- West 212 B- CC

Tools and Techniques for Modeling with Python

Sponsor: Computing Society

Sponsored Session

Chair: Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu

1 - GIMPy and GrUMPy: Visualization for Optimization in Python
Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Osman Ozaltin, Michael O'Sullivan, Aykut Bulut

In this talk, we discuss two related libraries for visualizing a wide variety of optimization algorithms. The first is for visualizing standard graph algorithms, while the second is for visualizing tree search algorithms, such as branch and bound. We'll discuss the use of these two libraries both in teaching and research.

2 - Advanced Modeling Techniques in Python
William E. Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, 87185, United States of America, wehart@sandia.gov, Jean-Paul Watson, Carl Laird, John D. Siirola, David L. Woodruff

Recently, a variety of algebraic modeling tools have been created within high-level programming languages, including C++, Java, Python and Ruby. We have previously argued that this allows modelers to leverage sophisticated language constructs and standard libraries, and that this enables a more expressive modeling environment. But is this claim true? This presentation critiques examples of modeling with the Pyomo software, which is built in Python.

3 - A Comparison of Optimization Modeling Software for Python
Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington VA 22201, United States of America, bjarni@maximalsoftware.com, Sandip Pindoria

We start with a quick overview, to demonstrate the many features of Python that make it good language for optimization and scientific computing, comparing it with other programming languages such as C/C++, Java and C#. Then we demonstrate a few examples of how to build and deploy optimization applications, using some of the component libraries currently available in Python, such as MPLPY, GUROBI, CPLEX, GAMS, LPSolve, PYOMO, and PULP-OR, while pointing out the main differences between them.

■ MC23

23- West 212 C- CC

Joint Session Wagner/CPMS: Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research & CPMS, The Practice Section

Invited Session

Chair: Allen Butler, Daniel H. Wagner Associates, 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, allen.butler@va.wagner.com

1 - Incorporating Stochastic Lead Times into the Guaranteed Service Model of Safety Stock Optimization
Salal Humair, Harvard School of Public Health, Boston MA, United States of America, shumair@hsph.harvard.edu, John Ruark, Brian Tomlin, Sean P. Willems

Variability, in its various forms, makes supply chain management hard. Most supply chain models incorporate demand variability but fewer models account for lead time variability, particularly in multi-echelon networks. We extend the guaranteed service model of safety stock placement to allow stochastic lead times. The main methodological contribution is the creation of closed form equations for the expected safety stock in the system. The main applied contributions are the demonstration of real stochastic lead times in practice and comparison to more traditional heuristics.

2 - Biological Planning for High-dose Rate Brachytherapy: Application to Cervical Cancer Treatment
Eva Lee, Professor and Director, Industrial and Systems Engineering Georgia Institute of Technology, Georgia Institute of Technology, Atlanta, GA, United States of America, eva.lee@gatech.edu, Fan Yuan, Jame CH Chu, Krystyna Liel, Alistair Templeton, Rui Yao

Cervical cancer is slow-growing and in early stages may not have any symptoms. Successful treatment remains challenging and the mortality rate in the U.S. is high at about 35%. We describe novel biological treatment planning designs that incorporate functional PET information for targeted escalated dose delivery. Our study reveals improvement both in local tumor control and organs-at-risk toxicity, two competing and desirable goals that were previously thought to be unachievable simultaneously.

■ MC24

24- West 213 A- CC

Healthcare Operations: Emergency Departments and Beyond

Sponsor: Health Applications Society

Sponsored Session

Chair: Soroush Saghafian, Arizona State University, Tempe, AZ, United States of America, soroush.saghafian@asu.edu

1 - Effect of Busyness in Hospital Care
Jillian Berry, Doctoral Candidate, Harvard University, Soldiers Field, Boston, MA, 02478, United States of America, jberry@hbs.edu, Anita Tucker

We examine how the Emergency Department (ED) is used as a buffer when a hospital is busy. We find that this behavior leads to greater overall resource utilization in the hospital. In particular, patients in the ED have a delayed admission, and this delay results in a change in length of stay (LOS) that is greater than the delay.

2 - Prioritizing Burn-injured Patients during a Disaster
Yina Lu, Columbia Business School, 3022 Broadway, 423 Uris Hall, New York, NY, 10027, ylu13@gsb.columbia.edu, Linda Green, Carri Chan

The US government has mandated that, in a catastrophic event, NYC areas need to be capable of caring for 400 burn patients. The current surged capacity is only 210. We develop a new system to prioritize patients for transfer to burn beds and demonstrate its superiority over several other methods. Based on data from previous burn disasters, we find that this is unlikely to meet federal guidelines. This work has implications for how disaster plans in other metropolitan areas should be developed.

3 - Emergency Department Simulation for Tackling Overcrowding
Vedat Verter, Professor, McGill University, 1001 Sherbrooke St. W., Montreal, QC, H3A 1G5, Canada, vedat.verter@mcgill.ca, Dr. Alrx Guttman, Antoinette Colacone, Dr. Eli Segal, Dr. Marc Afilalo

We have developed a comprehensive simulation model of a large emergency department in a tertiary hospital. The model has been verified based on extensive data concerning the patient flows as well as the direct and indirect activities of the physicians and nurses. This framework enables us to better understand the internal and external determinants of overcrowding and design interventions accordingly.

4 - An Enhanced Triage System for Emergency Departments
Soroush Saghafian, Arizona State University, Tempe, AZ, United States of America, soroush.saghafian@asu.edu, Mark Van Oyen, Jeffrey Desmond, Steven Kronick, Wallace Hopp

We propose a new triage system for hospital emergency departments that incorporates patient complexity as well as urgency. Using a combination of analytic and simulation models calibrated with hospital data, we demonstrate that the new triage system can substantially improve both patient safety and operational efficiency in emergency departments. We also investigate new patient flow designs as well as priority systems that can further improve the performance of Emergency Departments.

■ MC25

25- West 213 B- CC

Resource Allocation for Dynamical Health Systems

Sponsor: Health Applications Society

Sponsored Session

Chair: Stephen Chick, Professor, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, stephen.chick@insead.edu

1 - REACH: A Practical HIV Resource Allocation Tool for Decision Makers

Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, 94309, United States of America, ssabina@stanford.edu, Eduard Beck, Margaret Brandeau

Efficient allocation of HIV prevention and treatment funds is crucial but decision makers do not have good tools to support such decision making. We developed the Resource Allocation for Control of HIV (REACH) model, a planning tool for use by regional and country-level decision makers in evaluating potential resource allocations. We describe the model, present example analyses for three different settings, and describe our ongoing work in further developing and applying the model.

2 - Optimal Preventive Care Policies on Type 2 Diabetes Mellitus

Karca Aral, PhD Student, INSEAD, Technology and Operations Management, Boulevard de Constance, Fontainebleau, 77300, France, karca.aral@insead.edu

Type 2 Diabetes (T2D) is a chronic condition that affects over 285 million people worldwide. However, T2D and its related complications are preventable through healthier lifestyle and dietary choices. In this study, we introduce a population level progression model of T2D. We detail our findings on optimal preventive policies for resource allocation decisions regarding screening, public awareness and patient education programs for self-management around T2D.

3 - Sequential Monitoring of Glaucoma Patients

Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Ave., 2783 IOE, Ann Arbor, MI, 48109, United States of America, lavieri@umich.edu, Gregg Schell, Mark Van Oyen, Joshua Stein, MD, Jonathan Helm, David Musch

We develop novel algorithms to determine the best Time to Next Test based on each patient's individual disease trajectory. Our algorithms integrate a dynamic linear Gaussian systems model of disease progression with optimization approaches to predict the likelihood of glaucoma progression. We will present our closed form solutions and discuss the structural properties of the algorithms. Our work has been validated using patient data from a large-scale glaucoma clinical trial.

4 - Optimal Timing of the "Adoption with Research" Period for Conditional Reimbursement of Drugs

Leyla Mohseninejad, University Medical Center Groningen, Hanzeplein 1, Groningen, Gr, 9713 GZ, Netherlands, leymohnezh@gmail.com, Talitha Feenstra, Kuno Huisman, Maarten Postma, Cornelis Boersma, Erik Buskens

In the Dutch healthcare system, new inpatient drugs are conditionally reimbursed while additional research is undertaken to support a final decision. We present a framework to find the suitable time point for making a definite decision on a conditionally reimbursed drug. We consider the costs and benefits of extending the research period. Deriving the expected value of the additional information, and trading it off against the costs of delay, the expected net gains can be found and optimized.

■ MC26

26- North 221 A- CC

Retail Operations I

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Stephen Smith, Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95070, United States of America, SSmith@scu.edu

1 - The Retail Planning Problem under Demand Uncertainty

George Georgiadis, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, United States of America, georgiadis@ucla.edu, Kumar Rajaram

We consider the Retail Planning Problem in which a retailer chooses suppliers, and determines production, distribution and inventory planning for products with uncertain demand to minimize total expected costs. This problem is faced by retail chains that carry private label products. We formulate it as a convex MIP, which is NP-hard, and we construct bounding procedures. Our computational results indicate that the feasible solutions are close to optimal. Finally, we develop managerial insights.

2 - Multi-retailer Supply Chains with Nonlinear Production Costs: Centralized and Decentralized

Yigal Gerchak, Professor, Tel Aviv University, Ramat Aviv 69978, Israel, yigal@post.tau.ac.il, Gilad Schwartz

Several industries, such as the gasoline and apparel industries, that face nonlinear production costs in the short term, are undergoing spin-offs of retail operations. We study centralized and decentralized supply chains with multiple retailers and one manufacturer under uncertain demand, with both exogenous and endogenous prices. Our goal is to shed light on how nonlinear production costs combined with decentralization affect production quantities, prices and profits.

3 - Big Box Retailers in Emerging Markets: Boon or Bane?

Aditya Jain, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, aditya_Jain@isb.edu, Sameer Mathur, Saibal Ray

We study changing retailing environment in emerging market (India). In recent years several big retailing firms have entered the market traditionally dominated by small mom-and-pop stores. We consider asymmetric competition between a small (budget constraint) and large (capitalized) retailer in a market comprising of multiple segments (poor and rich). Using simple model we illustrate how presence of large retailer impacts pricing and assortment decisions, and consumer welfare.

4 - Optimal Inventory Allocation and Pricing with Non-Identical Stores

Stephen Smith, Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95070, United States of America, SSmith@scu.edu, Naren Agrawal

Retail chains must make decisions about allocation of inventory and clearance prices. Inventory decisions are often made before clearance prices are set, by which point, more precise demand information is available. We consider joint inventory allocation and clearance pricing decisions for retail chains with non-identical stores.

■ MC27

27- North 221 B- CC

Supply Risk, Pricing and Competition

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yimin Wang, Arizona State University, W. P. Carey School of Business, Department of Supply Chain Management, Tempe, AZ, 85287, United States of America, Yimin_Wang@asu.edu

1 - To Share or Not to Share? Contract Structures for Capacity Investments in Shared Suppliers

Anyan Qi, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, anyqi@umich.edu, Hyun-Soo Ahn, Amitabh Sinha

We study contracts governing capacity investment in shared suppliers. Two types of contract are considered: exclusive, where unused capacity cannot be used for others, and flexible, where it can. We find that firms generally pursue exclusive contracts, resulting in a prisoners' dilemma, and in equilibrium it is possible that only one firm invests in flexible capacity, and allows others to free-ride. Our work suggests an opportunity for the firms to co-operate to achieve a pareto-optimal outcome.

2 - Horizontal Capacity Coordination for Risk Management and Flexibility

Xiaole Wu, Assistant Professor, Fudan University, Room 513, Siyuan Building, 670 Guoshun Road, Shanghai, 200433, China, wuxiaole@fudan.edu.cn, Panos Kouvelis, Hirofumi Matsuo

Motivated by the dual sourcing and contracting practices in the semiconductor industry, we study two prevailing types of contracts that deal with horizontal capacity coordination issues between two possible sources: an integrated device manufacturer (IDM) and a foundry. Our analysis provides insights on horizontal capacity coordination beyond the semiconductor industry.

3 - Sourcing for Quality: Pricing, Inspection, and Cooperation

Cuihong Li, University of Connecticut, Storrs, CT, 06269, United States of America, cli@business.uconn.edu, Hsiao-Hui Lee

A buyer can provide price incentive for the supplier to exert quality improvement effort, use inspection to screen out defective units, or spend her own resource on cooperating with the supplier to improve incoming quality. We investigate the use of the three instruments to manage quality. We consider complementary and substitutable relationships between buyer cooperation and supplier effort on quality improvement, and compare the results with observable and unobservable supplier effort.

4 - Sourcing Strategy under Endogenous Pricing and Spillover Risk
Yixuan Xiao, Washington University in St. Louis, St. Louis, MO, 63130, United States of America, xiaoy@wustl.edu, Nan Yang, Yimin Wang

We study a buying firm's sourcing strategy when its proprietary design and technology may be misappropriated by its supplier. We characterize the buying firm's optimal strategy under both endogenous and exogenous spillovers, and provide managerial insights on how the buying firm's pricing strategy influences its spillover risk.

■ MC28

28- North 221 C- CC

Competitive Models in Operations/Marketing

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Hamed Mamani, University of Washington, Foster School of Business, Seattle, WA, United States of America, hmamani@uw.edu

Co-Chair: Foaad Iravani, PhD Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, foad.iravani.2012@anderson.ucla.edu

1 - Environmental Implications of Online vs. Brick-and-Mortar Retailing
Canan Savaskan-Ebert, Associate Professor, Cox Scghool of Business, P.O. Box 750333, Dallas, United States of America, csavaskan@mail.cox.smu.edu, Aydin Alptekinoglu, Ami Basu

In a competitive retailing model, in this paper, we explore environmental consequences of online and physical distribution channels. We develope insights with regards to the environmental implications of the sales tax policies for online channels.

2 - Competitive Aspects in Assortment Planning
Victor Martinez de Albeniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Sebastian Heese

We present a model where different assortment planning strategies are compared. We find that it is usually best to pre-announce the assortment size but not declare which suppliers are included. Furthermore, we show that the best assortment size is typically smaller than the one that a centralized system would choose. Hence, artificially limiting the assortment size seems an effective strategy to drive supplier competition.

3 - Combating Child Labor: Incentives and Information Transparency in Global Supply Chains
Soo-Haeng Cho, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, soohaeng@andrew.cmu.edu, Sridhar Tayur, Ying Xu

An estimated 158 million children aged 5-14 are engaged in child labor. Besides poverty in underdeveloped countries, extensive outsourcing has slowed child labor reform by encouraging firms to seek low labor costs. This paper examines the incentive of a multinational firm to induce or combat child labor via its supply contract and internal monitoring. We then investigate the potential effects of the new legislation in the U.S. that requires disclosures on corporate efforts to combat child labor.

4 - Coping with Gray Markets: The Impact of Market Conditions and Product Characteristics
Foaad Iravani, PhD Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, foad.iravani.2012@anderson.ucla.edu, Reza Ahmadi, Hamed Mamani

The diversion of products from authorized distribution channels to gray markets has created fierce competition for many manufacturers. We analyze the optimal strategy of a price-setting manufacturer who operates in two markets with uncertain demand and faces a gray market. We explore the impact of market conditions and product characteristics and provide insights about the viability of the uniform pricing policy that has been used by some companies to eliminate gray markets.

■ MC29

29- North 222 A- CC

Managing Delays in Access to Healthcare

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Mor Armony, Stern School of Business, NYU, New York, United States of America, marmony@stern.nyu.edu

1 - Discharge Planning to Mitigate Bed Block and ER Overcrowding
Rene Bekker, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, Netherlands, r.bekker@vu.nl, Jonathan Helm, Mark Van Oyen

Bed block in hospitals leads to long waits in Emergency Department, patients being placed in the hallways on stretchers, poor quality of care, high costs and mortalities. The timing of discharges from inpatient beds significantly impacts bed block, as the mismatch between arrivals and discharges over the day typically leads to a mid-day spike. This research models the intra-day census process and discharge timing and investigates how hospital characteristics impact bed blocking.

2 - Balancing between Timely Access to Medical Appointments and In-clinic Waits
Christos Zacharias, New York University, Stern School of Business, New York, United States of America, czachari@stern.nyu.edu, Mor Armony

We study the joint problem of determining the panel size of a medical practice and the number of offered appointments per day, so that patients do not face long backlogs, and the medical facility is not overcrowded. We consider the two separate time scales involved in patients' access to medical care: out-of-clinic waits for an appointment and in-clinic waits to see a physician, under state dependent partial backlogging. We provide system sizing guidelines based on heavy-traffic approximations.

3 - Step-Down Units in Hospitals: Benefits and Pitfalls
Mor Armony, Stern School of Business, NYU, New York, United States of America, marmony@stern.nyu.edu, Carri Chan, Bo Zhu

The use of Step-Down units (SDUs) in hospitals has been a matter of controversy in the medical community. On one hand, an SDU alleviates ICU congestion by providing a safe care environment for post-ICU patients before they can be transferred to the general wards. On the other hand, SDUs can take capacity away from the already over-congested ICU. We propose a queueing model that provides SDU sizing guidelines, noting that under some circumstances this optimal size is zero.

4 - Empirical Investigation into the Network Effects of Ambulance Diversion
Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, Sarang_Deo@isb.edu, Eric Park, Itai Gurvich

We use operations management theory to study the effects of change in ambulance diversion policy in LA County, CA. We utilize a unique dataset obtained by combining ambulance dispatch data and hospital diversion status data over a period of 9 years from a network of seven closely located hospitals. We find that extent of time on diversion reduced significantly after the policy change but the number of diversions did not. We build empirical models provide possible explanations for these effects.

■ MC30

30- North 222 B- CC

Commodity Risk Management

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Lingxiu Dong, Associate Professor, Olin Business School, Washington University, One Brookings Drive, Saint Louis, MO, United States of America, dong@wustl.edu

1 - Capacity Investment, Production Scheduling and Financing Choice
Derek Wang, University of Michigan, Wangdd@umich.edu, Owen Wu, Hyun-Soo Ahn

Mining/energy projects usually require huge initial investment beyond the firm's working capital. We study the capacity investment and production decisions of a capital-constrained firm that can finance through either debt or joint venture in a multi-period model. We show how financing schemes influence the operational policies and describe the conditions under which the firm chooses debt financing over joint venture.

2 - Commodity Processing and Financial Hedging: Under Correlated Price and Demand
Ankur Goel, Case Western Reserve University, Cleveland, Cleveland, United States of America, axg312@case.edu, Fehmi Tanrisever

We consider a publicly traded commodity processor, under perfect financial market, with an objective to maximize the value of its stakeholders when demand of output is correlated with its price. In a multi-period model, we develop optimal hedging and procurement policies in the presence of yield uncertainty and correlation between input and output price of the commodity.

3 - Dynamic Financial Hedging Strategies for a Storable Commodity with Demand Uncertainty
Zhan Pang, Lancaster University Management School, Department of Management Science, Lancaster, LA1 4YX, United Kingdom, z.pang@lancaster.ac.uk, Panos Kouvelis, Qing Ding

We consider a firm that is managing a storable commodity in the presence of demand uncertainty, a volatile spot market and associated financial derivatives. The objective is to coordinate the replenishment and financial hedging decisions to maximize the mean-variance utility of the terminal wealth over a finite horizon. We characterize the structure of optimal time-consistent policies. Our results shed new light into the interface between corporate risk management and operations management.

■ MC31

31- North 222 C- CC

Improved Inventory Policies and Supply Chain Coordination under Uncertainty

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Chase Rainwater, Assistant Professor, INEG Department, University of Arkansas, Fayetteville, AR, 72701, United States of America, cer@uark.edu

1 - Supplier Selection and Order Allocation under Supply Risks and Order Size Constraints
Yingying Wang, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, yywang1985@gmail.com, Donald Warsing, Russell E. King, Anita Vila-Parrish, Semra Ahiska

We consider a single-period, single-item, single-site inventory system with multiple suppliers, some of which are not perfectly reliable (delivery probability less than 1). The suppliers also may exhibit different fixed costs, item costs, and restrictions on minimum and maximum order sizes. Orders are allocated among suppliers to satisfy uncertain demand and minimize total costs. We develop and compare several algorithms to solve the problem under both continuous and discrete demand settings.

2 - Mitigating the Impact of National Drug Shortages for a Healthcare Facility
Samira Saedi, University of Houston, E209 Engineering Building, Houston, TX, 77204, United States of America, ssaedi@uh.edu, Erhun Kundakcioglu, Andrea Henry

A significant portion of public procurement spending js lost due to poor practices in pharmaceutical market such as inefficient inventory management. Along with national shortages, it causes lack of medicines leading to patients suffering. In this study, a continuous time Markov chain is considered to find the optimal inventory policy for a healthcare facility under supply and demand uncertainty. Simulation results show increase in availability of drugs and reduction in costs.

3 - The Benefit/Detriment of Information in Coordinating Supply Chains
Michael Wagner, St Mary's College of CA, 380 Moraga Rd, Moraga, CA, United States of America, mrw2@stmarys-ca.edu

We study a simple supply chain with a supplier and retailer, where one player knows the probabilistic distribution of demand and the other only knows the mean and variance. We show that this informational asymmetry either reduces or exacerbates the double marginalization effect. We study how the direction of asymmetry, level of uncertainty, economics and game theoretic considerations affect supply chain, as well as individual firm, performance.

■ MC32

32- North 223- CC

Temporal Product Variety

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Aydin Alptekinoglu, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, aalp@cox.smu.edu

1 - Product Updates in the Presence of Consumer Progression
Paulo Albuquerque, University of Rochester, Carol Simon Hall 3110R, Rochester, United States of America, paulo.albuquerque@simon.rochester.edu, Yulia Nevskaya

We propose a dynamic model to explain product usage in categories characterized by frequent updates and progression of consumer involvement. Examples of such categories include TV series, software, and books. Consumer utility depends on intrinsic preferences, social interaction and expectations about future content. We use data from the computer game "World of warcraft" to implement our model. We offer managerial recommendations to improve decisions on product innovation in these categories.

2 - Flexible Products for Dynamic Preferences
Aydin Alptekinoglu, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, aalp@cox.smu.edu, Karthik Ramachandran

We address a product design dilemma in the face of dynamic consumer preferences that change randomly over time. Is it better from a firm's perspective to offer multiple standard products (a set of dumbbells each with a specific weight) or one flexible product (a weight-adjustable dumbbell)? We find that higher ideal-product utility, more stable consumer preferences, and reduced durability all favor flexible products.

3 - Supply/demand Synchronization through Demand Shaping and Customer Analytics
Roger Lederman, Postdoctoral Research Scientist, IBM, Yorktown Heights, NY, United States of America, rdlederm@us.ibm.com, Marek Petrik

Demand shaping is the ability to sense demand patterns, evaluate, and execute actions to "steer" demand to better integrate the supply chain horizontally. We present a suite of mathematical models that enable demand shaping through dynamic management of product availability, price discounts, and sales levers across a portfolio of partially substitutable products. We discuss sensing, computation of optimal shaping actions, and insights from a real-life server computer manufacturing environment.

4 - The Role of Modular Upgradability as a Green Design Strategy
Sezer Ulku, Georgetown University, su8@georgetown.edu, Vishal Agrawal

We study the efficacy of modular upgradability as a design-for-environment strategy. By endogenizing a firm's development and introduction decisions and by considering a product's entire life cycle, we identify when modular upgradable architecture leads to lower environmental impact and is also more profitable for a firm.

■ MC33

33- North 224 A- CC

Green Business Models and Initiatives

Sponsor: Manufacturing & Service Oper Mgmt/Sustainable Operations

Sponsored Session

Chair: Vishal Agrawal, Assistant Professor, Georgetown University, Georgetown, United States of America, va64@georgetown.edu

1 - Energy Efficiency: Picking up the Twenty Dollar Bill
Deishin Lee, Harvard Business School, Soldiers Field Road, Boston, MA, 02163, United States of America, dlee@hbs.edu, Chonnikarn Fern Jira

Although numerous studies have shown that energy efficiency can simultaneously reduce environmental impact and increase firm profitability, many firms have not seized the opportunity to improve energy efficiency. We examine the organizational process of implementing capital-intensive energy efficiency projects using industrial waste heat recovery as an example.

2 - Electric Vehicles with a Switching Station: Adoption and Environmental Impact
Karan Girotra, INSEAD, Boulevard de Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Buket Avci

We analyze a novel switching-station based business model for the deployment of electric vehicles. The firm charges customers for the miles driven and establishes a network of battery swapping stations to enable rapid change of batteries. We compare this new service model to the traditional EV sales model in terms of market adoption and environmental impact. We also investigate how the advances in battery technology influence the adoption and environmental impact of the new model.

3 - Firm Collaboration to Eliminate the use of a Substance of Concern
Tim Kraft, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States of America, kraftt@darden.virginia.edu, Gal Raz

In this paper we analyze the conditions under which it is optimal for firms to collaborate to remove a potentially hazardous substance from their products. We consider the impact of market structure, existing regulatory threat, and market sensitivity on the collaboration decision and how the collaboration costs should be shared.

4 - The Potential of Servicizing as a Green Business Model
Vishal Agrawal, Assistant Professor, Georgetown University, Georgetown, United States of America, va64@georgetown.edu, Yannis Bellos

In recent years, manufacturers from various industries have begun to orient their practices towards selling the service of a product as opposed to selling the product itself. Moreover, such servicizing models have been proposed to be environmentally superior. In this paper, we investigate the economic, design, and environmental implications of such models and identify when and how different operational elements lead to lower environmental impact.

■ MC34

34- North 224 B- CC

Patents: Analysis and Use

Cluster: New Product Development

Invited Session

Chair: Jurgen Mihm, Assistant Professor, INSEAD, Fontainebleau, 77300, France, jurgen.mihm@insead.edu

1 - Emergence and Decline of Design Gurus
Haibo Liu, INSEAD, 1 Ayer Rajah Avenue 138676, Singapore, Singapore, HAIBO.Liu@insead.edu, Jurgen Mihm, Manuel Sosa

This study examines the creative output of individual designers over time and disentangles knowledge and social factors that predict both the emergence and decline of design gurus. We define design gurus as top ranked designers based on the citations received by their design patents. We test our hypotheses by using Event History Analysis on the design patents filed in United States Patent and Trademark Office (USPTO). Practical and theoretical implications for design management are discussed.

2 - Software Patent Policy: What Does Academic Research Have to Say?
David Pingry, Professor, University of Arizona, 430L McClelland Hall, Management Info Systems, Tucson, AZ, 85721-0108, United States of America, pingry@email.arizona.edu, Matt Thatcher

Since the patentability of computer software was first affirmed in 1981 there has been an explosion of software patents and a vigorous, twofold debate about software patent policy: 1. Should there be software patents? 2. If so, what should the policy parameters be? The academic literatures have had little impact on this important policy debate. This paper examines the state of the academic literatures in addressing these questions and proposes future directions for software policy research.

3 - On the Effectiveness of Patenting Strategies
Fabian Sting, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, FSting@rsm.nl, Jurgen Mihm, Tan Wang

What patenting strategy should a company pursue? What factors should the choice of strategy depend on? We build a coherent inventory of patenting strategies and we integrate it into a common coherent framework. Through a simulation model, we identify competitive dynamics as the most crucial contingency and within our framework we characterize the optimal patenting choices. Our research makes a step towards a contingency theory of patenting strategies.

4 - Corporate R&D Allocations in Systems Industries
Markus Reitzig, Vienna University, Brünnerstrafle 72, Vienna, Austria, markus.reitzig@univie.ac.at, Ramon Lecuona Torras

The goal of this research project is to better understand how (and why) corporations allocate resource and development (R&D) investments across technological landscapes in so-called system industries (i.e. industries in which sets of inter-related components constitute final consumer products).

■ MC35

35- North 225 A- CC

Joint Session RMPS/AAS: Approximation Methods for Revenue Management and Pricing

Sponsor: Revenue Management & Pricing & Aviation Applications

Sponsored Session

Chair: Dan Zhang, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, dan.zhang@colorado.edu

Co-Chair: Thomas Vossen, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, vossen@colorado.edu

1 - Approximation Scheme for Robust Dynamic Pricing with Two Substitutable Products
Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu, Ming Chen

We consider a dynamic pricing problem with two substitutable products with a number of business rules. We formulate the problem as a max-min problem which maximizes the worst-case total sales revenue over all possible demand realizations in the demand uncertainty spaces subject to constraints induced by the given business rules and the nature of substitution between the two products. We give a DP algorithm and develop a FPTAS which guarantees a proven near optimal solution in a manageable time.

2 - Joint Stocking and Product Offer Decisions under the Multinomial Logit Model
Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu

We study a stocking and product offer problem, where we need to decide which sets of products to offer over the selling horizon and how many units of each product to stock given that customers choose among the offered products according to the multinomial logit model. We give a formulation of the problem with a separable objective function, which allows solution via dynamic programming. We study the properties of the optimal assortment.

3 - A Dynamic Disaggregation Approach to Approximate Linear Programs for Network Revenue Management
Dan Zhang, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, dan.zhang@colorado.edu, Thomas Vossen

We consider the approximate linear program (ALP) resulting from an affine functional approximation to the network revenue management problem. We show that the ALP can be reduced to an equivalent, albeit much smaller, linear program. Our proof exploits the relationship between the ALP and an appropriate Dantzig-Wolfe reformulation. We develop a novel dynamic disaggregation algorithm to solve the reduced program. We generalize our results to choice-based network revenue management.

4 - Equivalence of Piecewise-linear Approximation and Lagrangian Relaxation for NRM
Sumit Kunnumkal, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, A.P, AP, India, sumit_kunnumkal@isb.edu, Kalyan Talluri

The network RM problem can be formulated as a DP with an exponentially large state space. A number of heuristics have been proposed to approximate it. Notable amongst these are ADP methods that approximate the value function by basis functions and decomposition methods that relax the constraints of the DP to solve simpler DPs. We show that these two seemingly distinct approaches coincide, i.e., the piecewise-linear approximation method and the Lagrangian relaxation method are one and the same.

5 - Power Approximations for Network Revenue Management
Dan Adelman, Professor of Operations Management, University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, United States of America, dan.adelman@chicagobooth.edu, Christiane Barz, Canan Uckun

We consider a new approximation architecture for the network revenue management problem using power functions to express concavity. We address a number of technical challenges in fitting parameters and demonstrate numerical performance compared against other approximations.

■ MC36

36- North 225 B- CC

Pricing and Supply Chain Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Tim Huh, University of British Columbia, Sauder School of Business, Vancouver, Canada, tim.huh@sauder.ubc.ca

1 - Price and Reorder Flexibility for Differentiated Short Lifecycle Products under Competition

Philipp Afeche, Rotman School of Management, University of Toronto, 105 St.George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca, Ming Hu, Yang Li

We study competing providers of differentiated short lifecycle products with uncertain demand. They place initial orders before, and choose prices and reorder quantities after observing demand. We (1) show that the expected profit functions may be bimodal and characterize the equilibrium order/reorder and pricing strategies; (2) quantify under what conditions reorder flexibility increases or hurts profitability; (3) discuss how the mode of competition affects the value of volume flexibility.

2 - Impact of Strategic Customer Behavior and Rollover Strategies on Product Innovation

Metin Cakanyildirim, Associate Professor of Operations Management, University of Texas at Dallas, P. O. Box 830688, Richardson, TX, 75080-0688, United States of America, metin@utdallas.edu, chao liang, Suresh Sethi

Innovation rate, orders, prices and profit are analyzed in four settings: myopic or strategic customers, and single or dual (product) rollover for product transitions. With myopic customers, single rollover hurts the profit but accelerates the innovation process, and the innovation rate and profit cannot be increased simultaneously with any rollover strategy. With strategic customers, a firm can provide a more innovative product, earn a higher profit with the appropriate rollover strategy.

3 - Analysis of Inventory Problems with Inventory-dependent Demand

Frank (Youhua) Chen, Professor, City University of Hong Kong, College of Business, Dept. of Management Science, Kowloonton, Hong Kong-PRC, youhchen@cityu.edu.hk, Yi Yang, Weili Xue

We attempt to address a set of problems in which underlying demand depends on the (displayed) inventory level. Generally, inventory as a demand determinant is just one of the many sales levers, such as pricing. Can the approaches developed in the literature of inventory-pricing be extended to analyze the current problems? In this talk we examine periodic-review systems where inventories may be displayed on shelf or stored in backroom and present structural results.

4 - A Call-Back Auction for Oversold Flights

Sean Zhou, CUHK, Shatin, N.T., Hong Kong, Hong Kong-PRC, zhoux@se.cuhk.edu.hk, Zhiheng Zhong

Overbooking has been a widely used strategy by airlines to increase their revenue. However, customers are upset when they were bumped at the gate, which may also affect the future revenue of the airline. We propose and analyze a call-back auction mechanism, in which the passengers are asked to submit a bid when they purchase the tickets, which indicates the compensation they would like to receive for giving up their tickets. Comparison is made between this mechanism and the existing ones.

■ MC37

37- North 226 A- CC

Location Modeling and Applications

Sponsor: Location Analysis

Sponsored Session

Chair: Erhan Kutanoglu, The University of Texas at Austin, 204 E Dean Keeton St. C2200, Austin, TX, 78712, United States of America, erhank@mail.utexas.edu

1 - Sequential Clustering for Police Districting

Christopher Rump, Associate Professor, Bowling Green State University, Applied Statistics & Operations Research, Bowling Green, OH, 43403, United States of America, cmrump@bgsu.edu

We consider the problem of designing police command districts and, at a more granular level, police patrol beats. In doing so, we consider a hierarchy of clustering objectives to measure the overall distance within each formed district. The districting design optimization problem is modeled heuristically as a sequential clustering problem that for most choices of clustering objective can be solved efficiently via its linear programming relaxation.

2 - Positional Uncertainty in Coverage Modeling

Alan Murray, Professor, Arizona State University, P.O. Box 875302, Tempe, AZ, 85287, United States of America, atmurray@asu.edu

Coverage models have proven to be both theoretically interesting and of great practical significance. This paper reviews aspects of positional uncertainty and how this may impact coverage modeling. Extensions to account for positional uncertainty as well as empirical applications are detailed.

3 - Dual-based Local Search for Deterministic, Stochastic, and Robust Variants of the ConFL Problem

Gisela Bardossy, Assistant Professor of Operations Research, University of Baltimore, 1420 N. Charles Street, Baltimore MD 21201, United States of America, mgbardossy@gmail.com

We study a family of network design problems that arise in settings ranging from telecommunications to data management. We investigate the use of heuristic search procedures coupled with lower bounding mechanisms to obtain high quality solutions for deterministic, stochastic and robust variants of these problems. We extend methods, such as sample average approximation for stochastic optimization and the Bertsimas and Sim approach for robust optimization with heuristics, and widen their usability.

4 - Protection Planning for Critical Infrastructure Systems in Location Analysis: Models and Algorithms

Federico Liberatore, University of Kent, Kent Business School, Kent, Canterbury, United Kingdom, federico.liberatore@urjc.es, Maria Paola Scaparra

The aim of this thesis is to contribute to the expansion and growth of the field of supply system reliability and facility protection. The main objective of this research is to formulate and solve optimization models that incorporate the characteristics of complex supply systems in order to mitigate the impact of destructions or malfunctionings of critical infrastructure.

■ MC38

38- North 226 B- CC

Panel Discussion: Meet the Editors of the INFORMS Service Science Journal

Sponsor: Service Science

Sponsored Session

Chair: Gregory Heim, Associate Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, gheim@mays.tamu.edu

1 - Service Science Editorial Board Q&A

Moderator: Cheng Hsu, Rensselaer Polytechnic Institute, Dept. of Industrial & Systems Engineering, Troy NY 12180, United States of America, hsuc@rpi.edu

Service Science Editorial Board welcomes questions and suggestions from the community. This interactive session also aims at assisting our readers in staying informed on the most important topics and the latest development in Service Science.

■ MC39

39- North 226 C- CC

IT in the Service Industry

Contributed Session

Chair: Rama Akkiraju, Distinguished Engineer, Service Solution Design, IBM Research, 650 Harry Road, Almaden Research Center, San Jose, CA, 95120, United States of America, akkiraju@us.ibm.com

1 - Dialog Manager for IT Service Management

Juhnyoung Lee, Research Staff Member, IBM, 19 Skyline Drive, Hawthorne, NY, 10598, United States of America, jyl@us.ibm.com, Rangachari Anand

The Dialog Manager is a web-based software tool for documenting and organizing procedural knowledge. It provides a Wiki-style tool for authoring knowledge for resolving issues as structured conversations. It provides the authored knowledge to support staff at call centers for resolving incidents. It offers the authored content searchable and provides conversation state management in reusing the content in the issue resolution process.

2 - IT Incident Diagnosis by Incident Relation Analysis
Rong Liu, IBM, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, rliu@us.ibm.com, Juhnyoung Lee

The objective of IT incident management is to maintain high level of service quality and to restore normal service operations as quickly as possible in case of IT failures. In this paper, we present a novel and reusable analytical platform that integrates events from different data sources and provides predictive analytical capabilities by utilizing relations among incidents. It provides a prediction model of IT failures that anticipates failures and offers prevention and resolution actions.

3 - Development of Service Concepts for Automobiles using a Data-driven Approach
Min Jun Kim, POSTECH, Hyoja-Dong. Nam-Gu.Pohang. Kyungbuk, Pohang, Korea, Republic of, minjun@postech.ac.kr, Hyun-Jin Kim, Chie-Hyeon Lim, Kwang-Jae Kim

Advanced IT technologies enable automobile companies to provide services based on the trip data collected from customers' vehicles. In this talk, we present a data-driven approach to developing vehicle-related service concepts. The approach identifies service opportunities by understanding how customers drive by analyzing the data. Some of the identified opportunities are elaborated to form service concepts. The approach is demonstrated through a case study on the automobile telematics service.

4 - Assessing the Competitiveness of an IT Outsourcing Solution
Rama Akkiraju, Distinguished Engineer, Service Solution Design, IBM Research, 650 Harry Road, Almaden Research Center, San Jose, CA, 95120, United States of America, akkiraju@us.ibm.com, Tobin Lehman

Assessing the competitiveness of an IT outsourcing solution is a non-trivial task. It involves comparing unit costs and unit prices of complex service solutions with comparable prior deals and market data. Complex financial factors, cost allocations and customizations make determining 'comparables' quite involved. We present a mechanism and an analysis tool to assess the competitiveness of IT outsourcing solutions.

■ MC40

40- North 227 A- CC

Use of Recycled and Renewable Materials in Production Planning

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Randolph Kirchain, Principal Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave, E38-432, Cambridge, MA, 02139, United States of America, kirchain@mit.edu

1 - Coordination and Flexibility Tradeoffs in Aluminum Recycling
Elsa Olivetti, Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave., E38-434, Cambridge, MA, 02139, United States of America, elsao@MIT.EDU, Tracey Brommer, Randolph Kirchain

Recycling offers environmental and economic benefits to the aluminum industry, whose costs are driven by electricity use. This work explores models to improve recycling of aluminum including metal recovery from byproducts of production process. Models are developed to examine the value of operating coordinated recycling centers and aluminum remelting plants. The analysis quantifies the value of flexibility given the practical constraints of the operation and variation in product demand.

2 - Uncertainty Analysis of a Mass Flow and Economic Model of Electronics Recycling Systems
Jeremy Gregory, Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave., E38-424, Cambridge, MA, 02139, United States of America, jgregory@mit.edu, Boma Brown-West, Randolph Kirchain

As electronics recycling systems become more widespread, analyzing the performance of such systems is critical for the evaluation of existing systems and the design of new ones. This work involves performance analysis of electronics recycling systems using a mass flow and economic model that quantifies the variation in economic performance of a recycling system due to product, collection, and market uncertainties. The goal is to highlight scenarios that may lead to economic success.

3 - Take Back Costs and Product Durability
Michael Pangburn, Lundquist College of Business, University of Oregon, Eugene, OR, 97403, United States of America, pangburn@uoregon.edu, Euthemia Stavrulaki

Due to EPR programs a firm may take back a fraction of its failed products. Extending a classic 2-period durable goods framework, we analyze the impact of take back costs on a firm's product durability choice. We show that compared to selling, leasing provides an incentive to raise durability, and that it is possible for the optimal durability to decrease if take backs increase. Leasing implies higher durability and profit, yet we find selling yields higher surplus in some settings.

4 - Enabling Increased Recycling & Renewable Materials use through Explicit Consideration of Uncertainty
Randolph Kirchain, Principal Research Scientist, Massachusetts Institute of Technology, 77 Massachusetts Ave., E38-432, Cambridge, MA, 02139, United States of America, kirchain@mit.edu, Elsa Olivetti

Increasing the use of recycled and renewable resources can enable energy savings, forestall depletion and avoid the deleterious effects of extraction. We discuss methods for increasing use of these materials through control of incoming feedstock quality variation. Research has shown that explicit incorporation of uncertainty, robust long term batch planning, and informed final product design through the use of stochastic programming can increase the use of recycled and renewable materials.

■ MC41

41- North 227 B- CC

Energy Generation

Contributed Session

Chair: Carlos Ruiz, École Centrale Paris and Supélec, Grande Voie des Vignes, Châtenay-Malabry, 92295, France, carlosruizmora@gmail.com

1 - Evaluating the Impacts of EU ETS on the Italian Electricity Market
Giorgia Oggioni, Assistant Professor, University of Brescia, Contrada Santa Chiara, 50, Brescia, 25122, Italy, oggioni@eco.unibs.it, Francesca Bonenti, Giacomo Marangoni, Elisabetta Allevi

We investigate the economic impacts of the European Union Emissions Trading Scheme (EU ETS)on the Italian electricity market by a power generation expansion model where generators behave either as Cournot or perfectly competitive players. The developed models are used to measure the effects of the EU ETS on electricity prices and demand, investments and generators' profits. Models are formulated as complementarity problems with endogenous energy and CO2 prices and are implemented in GAMS.

2 - Multi-objective Generation Expansion Planning (GEP) Optimization using Pareto Uncertainty Index
Saltuk Selcuklu, Rutgers University, 96 Frelinghuysen Road, CORE Building, Room 201, Piscataway, NJ, 08854, United States of America, bugrasel@gmail.com, Mark Rodgers, Frank Felder, David Coit

The GEP problem is a stochastic multi-objective optimization problem. For multi-objective optimization problems, a common solution methodology is to determine a Pareto optimal set. However, the Pareto optimal set gives deterministic results. Our research aims to introduce Pareto Uncertainty Index which can reflect the stochastic nature of the problem to the results. The proposed method will be applied to the GEP to find solutions which are likely to be less risky to the decision maker.

3 - Distributed Energy Scheduler
Mohammadjavad Feizollahi, PhD Student, Georgia Institute of Technology, 755 Ferst Dr.NW, Atlanta, GA, 30332, United States of America, feizollahi@gatech.edu, Shabbir Ahmed, Santiago Grijalva

In this study, we propose a Distributed Energy Scheduler model capable of determining the optimal schedule of power generation, consumption, storage and transmission with maximum total utility of power prosumers (producer-customers), satisfying physical limits of utilities and transmission systems, power balance and demand constraints in a multi-stage and flat configuration framework. We study performance and convergence of the algorithm and analyze the quality and sensitivity of the solutions.

4 - A Multi-criteria and Multi-year Planning for Distributed Generation with Renewable Power
Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, United States of America, tj17@txstate.edu, Clara Novoa

Distributed generation planning aims to determine the generator type, capacity, placement, and maintenance such that the cost is minimized, and the loss-of-load probability is minimized. Power intermittency and load uncertainty are the key issues caused by increased penetration of wind, solar, and electric vehicles. We formulate the planning problem as a mixed-integer stochastic decision model which is solved by simulation-based optimization algorithms.

5 - Simulation and Optimization of Renewable Generators Allocation in a Distribution Network

Rodrigo Mena, École Centrale Paris and Supèlec, Grande Voie des Vignes, Châtenay-Malabry, 9225, France, rodrigo.mena@ecp.fr, Carlos Ruiz, Enrico Zio, Yanfu Li

We propose a framework for the simulation and multi-objective optimization framework of an electrical distribution network with the installation of multiple renewable generators and storage devices. The framework allows accounting for the uncertainties in the renewable resources, network components failures and repairs, variability of loads and grid power supply. The objectives of the optimization are minimizing the overall system cost and maximizing the reliability in power supply.

■ MC42

42- North 227 C- CC

Transportation Networks and Plug-in Electric Vehicles II

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Chi Xie, Research Associate, The University of Texas at Austin, 1616 Guadalupe St, UTA 4.403, Austin, TX, 78701, United States of America, chi.xie@mail.utexas.edu

1 - Electric Vehicles Routing: Shortest Path Problem with Recharging

Nan Jiang, The University of Texas at Austin, 301 E. Dean Keeton St., Stop C1761, Austin, TX, 78712, United States of America, jiang@utexas.edu, Chi Xie, Jennifer Duthie, Travis Waller

A special constrained shortest path problem considering electric vehicles' en route recharging requirements is studied. An integer programming formulation is developed. Three solution algorithms are proposed and their computational performance is compared.

2 - Accommodating Electric Vehicle Charging in California's Power Sector: Regional Impacts on Emissions

Julia Sohnen, University of California, Institute of Transportation Studies, Davis, CA, 95616, United States of America, jmsohnen@ucdavis.edu, Christopher Yang, Yueyue Fan, Joan Ogden

The carbon intensity of electricity generation depends on the available resource mix and current demand, which vary by time-of-day, season and location. We present a least-cost dispatch model of the California grid to assess temporal and spatial impacts on emissions due to electric vehicle charging. Dispatch decisions depend on price, location, resource mix, and transmission capacity. Emissions assigned to vehicle charging are assigned by looking at marginal generation required at each location.

3 - Localized Charging Policies for Greener Transportation Electrification

Mahdi Kefayati, Research Assistant, The University of Texas at Austin, 2501 Speedway Stop C0803 ENS 541, Austin, TX, 78712, United States of America, kefayati@utexas.edu, Ross Baldick

By analyzing PEV charging demand based on empirical traffic data, we first show that there is substantial flexibility in controlling charging rate, without sacrificing users' comfort. Then, we show that the aggregate load of PEVs, if charged like conventional loads, exacerbates the diurnal variability of electricity demand. Finally, we propose a localized charge rate control policy that reduces PEV load coincidence with conventional demand and increases its correlation with wind energy.

■ MC43

43- North 228 A- CC

Recent Advances in Yard and Shop Optimization and Analytics

Sponsor: Railway Applications

Sponsored Session

Chair: Krishna Jha, Vice President (R&D), Innovative Scheduling, 2153 SE Hawtorne Road, Gainesville, FL, 32641, United States of America, krishna@innovativescheduling.com

1 - Applying AnyLogic Simulation Software to Flat Yard Analysis

Roger Baugher, Director, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United Kingdom, Roger.Baugher@BNSF.com

AnyLogic is a general purpose simulation tool enabling development of agent-based, system dynamics, and discrete-event models, in any combination. Among the specialized libraries is the Rail Library that understands the railroad environment – track, switches, trains, cars, coupling, routing, etc. The software exploits the object-oriented framework provided by Java. Using the tool, replay of activity at a flat yard will be demonstrated, and the features of the AnyLogic system discussed.

2 - Delivering Value from Hump Yard Simulation Models

Jeremiah Dirnberger, Manager-Operations Planning, CSX Transportation, 500 Water St. J315, Jacksonville, FL, 32202, United States of America, Jeremiah_Dirnberger@csx.com, Krishna Jha

Although building and validating simulation models of complex systems is no easy task, the real value of the models comes from their use and acceptance after validation is complete. While continuing to build additional hump yard models with Innovative Scheduling, CSX has worked to create processes that derive value from the existing models. This presentation will show how CSX has used the Hump Yard Simulation System to make better decisions in tactical, strategic and conceptual scenarios.

3 - Optimal Locomotive Shop Location and Capacity Planning

Kamalesh Somani, Manager Operations Research, CSX Transportation, 500 Water St., Jacksonville, FL, 32202, Kamalesh_Somani@csx.com, Weijun Xie, Yanfeng Ouyang

Multiple levels of locomotive maintenance and repair are done by Locomotive Shops with various capabilities located at some major yards in the railroad network. Strategically, it is of interest to find the optimal location of locomotive shops and the capacity of these facilities. We have designed a MIP formulation to solve this problem. Numerical study is conducted to verify the model.

4 - Analysis of Railroad Terminal Operational Decision Making

Edward Lin, Manager Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309-3579, United States of America, edward.lin@nscorp.com, Clark Cheng

Rail classification yards sort and regroup railcars to their next destinations in the rail network. A number of decisions are made in each process to ensure that cars are handled efficiently and safely to meet performance measures and resources are fully utilized. Proper analysis of activities can provide valuable insights that help OR modelers improve algorithms as well as help yard personnel improve operations.

■ MC44

44- North 228 B- CC

Supply Chain Optimization

Contributed Session

Chair: Avi Giloni, Sy Syms School of Business Yeshiva University, 500 West 185th Street, BH 428, New York, NY, 10033, United States of America, agiloni@yu.edu

1 - Analysis of the Best Double Frequency Policy in the Single Link Problem with Discrete Shipping Times

Luca Bertazzi, Professor, University of Brescia, Contrada Santa Chiara 50, Brescia, 25122, Italy, bertazzi@eco.unibs.it, Lap Mui Ann Chan

We study the problem of shipping products from an origin to a destination. The problem is to decide when to make the shipments and the quantity to send in order to minimize the sum of the transportation and the inventory costs. We show the worst-case performance bound of the Best Double Frequency policy. Moreover, we show that it is not possible to improve this bound by allowing more shipping frequencies. Finally, we show that the Best Double Frequency policy is very effective on average.

2 - Determining the Optimal Supply Chain Policies for the Dairy Industry in Puerto Rico

Lourdes Fernandez, University of Puerto Rico, Mayaguez Campus, Call Box 9000, Mayaguez, PR, 00680, Puerto Rico, lourdes.fernandez@upr.edu, Betzabè Rodrìguez

The Dairy Industry of Puerto Rico has a Milk's Price Stabilization Program to ensure a fair and proportionate price for producers and farmers. Furthermore, a maximum fresh milk production volume was established and excess milk produced has traditionally being sold to a privately own company or discarded. The objective of this research is to develop a model to find the best operational policies to ensure the optimal performance of the supply chain.

3 - A Solution Approach for Capacitated Multi-echelon Supply Chain Network Problem

Kangbok Lee, Research Associate Professor, Rutgers University, 1 Washington Park Room 906, Newark, NJ, 07102, United States of America, kangblee@business.rutgers.edu, Hui Dong, Lei Lei

We consider a capacitated multi-echelon supply chain network problem with batching production and delivery at manufacturers, unit packaging process at packaging centers. For a special case with one packaging center and an identical order size, we propose a strongly polynomial time algorithm by decomposition approach. For a general case, we present an approximation algorithm along with experimental result.

4 - Assessing the Difference Between Shock Sharing and Demand Sharing in Supply Chains

Avi Giloni, Sy Syms School of Business Yeshiva University, 500 West 185th Street, BH 428, New York, NY, 10033, United States of America, agiloni@yu.edu, Vladmir Kovtun, Cliff Hurvich

We consider the problem of assessing value of demand sharing in a multi-stage supply chain in which the retailer observes stationary ARMA demand. We provide conditions under which demand sharing is (i) equivalent to no sharing, (ii) equivalent to full information shock sharing, and (iii) intermediate in value to the two previously described arrangements. We then show that under these three possible sharing arrangements, demand propagates through a supply chain as QUARMA-in-QUARMA-out.

■ MC45

45- North 229 A- CC

Panel Discussion: Industry Job Search

Cluster: Job Placement Services

Invited Session

Chair: Bala Shetty, Professor, Texas A & M University, College Station, TX, United States of America, b-shetty@tamu.edu

1 - Panel Discussion: Industry Job Search

Moderator: Bala Shetty, Professor, Texas A & M University, College Station, TX, United States of America, b-shetty@tamu.edu, Panelists: Hossam Zaki, Bruce Patty, Irv Lustig

The panel will discuss the industry interview process and do's and don'ts associated with the job search. In addition to comments from current and former recruiters, time will be provided for questions and answers.

■ MC46

46- North 229 B- CC

Organizational and Industry Renewal (IV): Consortia, Alliances and Collaborations

Sponsor: Organization Science

Sponsored Session

Chair: Andreas Schwab, Associate Professor, Iowa State University, 3315 Gerdin, Ames, IA, 50011, United States of America, aschwab@iastate.edu

1 - SME Relationships with Non-Academic Research Institutes

Benjamin Weber, EBS Business School Strascheg Institute for Innovation and Entrepreneurship, Burgstr. 4, Oestrich-Winkel, 65375, Germany, benjamin.weber@ebs.edu, Florian Taeube, Friedemann Polzin

Innovation is a growth driver SMEs cannot ignore for their long term survival strategy. However, few SMEs can master the innovation process alone because research capabilities are scarce. Cooperations are seen as a solution for this obstacle. We surveyed 150 SMEs regarding innovation cooperations with other firms and research institutes. The aim of our study is to find out how innovation can emerge from cooperations and how to foster this process.

2 - Financing Eco-innovation– The Determinants of Cooperation to Bridge the Valley of Death

Friedemann Polzin, EBS Business School Strascheg Institute for Innovation and Entrepreneurship, Rheingaustr. 1, Oestrich-Winkel, 65375, Germany, polzin@instoec.de, Paschen von Flotow, Florian Taeube, Benjamin Weber

A main obstacle to effective commercialization and diffusion of clean technologies lies in the absent cooperation between financiers and innovators. I conduct expert interviews among project managers and survey stakeholders of government supported cooperative research projects (CRP) to explore this phenomenon. As results I expect a framework for the management of CRP and complementary industrial regulations to reduce information asymmetries in order to mitigate this innovation system failure.

3 - The Value of Process Development Alliances under Demand Uncertainty

Hiroki Sano, University of Texas McCombs School of Business, 1 University Station B6500, Austin, TX, 78712, United States of America, Hiroki.Sano@phd.mccombs.utexas.edu, Edward Anderson

Semiconductor manufacturers are forming alliances to develop common design rules that enable them to easily pool their capacities to manage demand uncertainty. We develop a game-theoretic model to study the benefits of this arrangement when the member firms' markets can be substitutes or complements.

■ MC47

47- North 230- CC

Advances on V2V and V2I Communications

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Bruce Wang, Professor, Texas A & M University, College Station, TX, United States of America, bwang@tamu.edu

1 - A Mathematical Modeling for the Temporal and Geographic Propagation of Information in Vehicle-to-Vehicle Communications

Yong Hoon Kim, Purdue University, 3000 Kent Ave, West Lafayette IN 47906, United States of America, kim523@purdue.edu, Srinivas Peeta

This study proposes a mathematical model for the dynamics of information propagation in large-scale vehicle-to-vehicle (V2V) communications based traffic networks. The proposed model aims to obtain a better understanding of the interacting processes of information propagation and the dynamics of traffic flow. Insights will be illustrated using the results obtained through the mathematical modeling and the simulated data.

2 - Social Network Analysis for Information Networks under V2V Communication Based Traffic Systems

Choungryeol Lee, Purdue University, West Lafayette, IN, United States of America, lee1210@purdue.edu, Srinivas Peeta

We proposes a graph-theoretical approach to model the information network which results from wireless connections of equipped vehicles in a traffic network through Vehicle-to-Vehicle (V2V) communications. This study presents metrics based on social network analysis to understand structural characteristics and dynamics of the information network. Further, based on simulation experiments, we discuss the results and an approach to explore the structural evolution of the information network over time.

3 - Vehicle-to-Vehicle Connectivity on Two Parallel Roadways with a General Headway Distribution

Bruce Wang, Professor, Texas A&M University, College Station, TX, United States of America, bwang@tamu.edu, Kai Yin, Yunglong Zhang

In this paper, we propose analytical models for the vehicle connectivity on two parallel roadways, assuming general distributions for vehicle headways. Models are derived for the expectation, variance and probability distribution of information propagation distance. Closed form approximation to the expectation is obtained and is numerically shown to agree well with the exact models. In addition, we discuss the effects of signal interference on the information propagation. Monte Carlo simulation results further validate the proposed models. Through simulations, the developed models are also shown to have overcome the deficiencies associated with the commonly used one-roadway models and models with the Poisson assumption for vehicle distribution.

4 - Using Dynamic Congestion Tolling and V2I Communication for Decentralized Optimal Routing
Hao Zhou, University of Michigan, 1205 Beal Ave., IOE Building, Ann Arbor, MI, 48109, United States of America, haozhou@umich.edu, Romesh Saigal

In this research, we consider a traffic network with dynamic congestion toll on each link, and vehicles capable of communicating with central controller. Each vehicle receives real-time toll prices and traffic information of all links, and tries to optimize its route choice based on its own preference. We developed a model to dynamically update toll prices on each link to minimize overall delay of vehicles.

5 - Predictive Speed Harmonization and Control of Flow Breakdown in a Connected Vehicle Environment
Alireza Talebpour, Northwestern University, Evanston, IL, 60208, United States of America, AlirezaTalebpour2014@u.northwestern.edu, Hani S. Mahmassani

Microscopic simulation is used to evaluate the effectiveness of speed harmonization strategies intended to avoid or delay the onset of breakdown and shock wave formation on freeways. Implementation in a connected vehicle environment is discussed.

■ MC48

48- North 231 A- CC

Dynamic Routing

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, Technological Institute M235, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Real-Time Orienteering Problem with Stochastic Travel Times
Irina Dolinskaya, Assistant Professor, Northwestern University, Technological Institute M235, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, dolira@northwestern.edu, Karen Smilowitz, Zhenyu (Edwin) Shi

We study an extension of the orienteering problem (OP) with stochastic travel times where network information is updated in real-time. Furthermore, the decisions regarding customer sequence and path choice affect the information gathered, requiring exploration vs. exploitation analysis. We present adaptive path planning methods to take advantage of this data, combining OP and optimal path finding. Application to search-and-rescue operations in a disaster affected region is also presented.

2 - Dynamic Fleet Routing via Tabu Search
Doug Popken, Systems View, 2127 Mountain Maple Avenue, Highlands Ranch, CO, United States of America, dpopken@systemsview.com

Systems View is upgrading the intranet based route management system of an auto shipper client to include a dynamic route optimization capability. Routes have complex capacity and timing constraints, with pickup and dropoff locations throughout the United States. A prototype, using a series of insertion based heuristics, generated enthusiasm for more advanced algorithms. This talk describes the development and deployment of a classic tabu search meta algorithm that guides the heuristics to producing sets of high-quality routes.

3 - Policy Evaluation and Cyclic-order Search for the Multi-compartment VRP with Stochastic Demands
Justin Goodson, Saint Louis University, 3674 Lindell Blvd., St. Louis, MO, 63108, United States of America, goodson@slu.edu

We develop methods to estimate and exactly calculate the expected cost of a priori policies for the multi-compartment vehicle routing problem with stochastic demands. We incorporate our estimation procedure into a cyclic-order-based simulated annealing algorithm, significantly improving the best-known solution values for a set of benchmark problems. We also extend the updating procedure for a cyclic order's candidate route set to duration-constrained a priori policies.

4 - Finding Eco Routes in a Time-dependent Traffic Network
Hao Lei, Phd Student, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, hao.lei@utah.edu

This talk presents algorithms for estimating and finding the time-dependent eco-friendly route in a transportation network. A cross-resolution traffic model is first adapted to provide accurate traffic state and emission forecasts. A dynamic least cost path-finding algorithm with reduced search space is developed to efficiently compute route solutions with the least emissions.

5 - Routing for Customer Relationship
Shu Zhang, University of Iowa, Iowa City, IA, United States of America, shu-zhang-1@uiowa.edu, Jeffrey W. Ohlmann, Barrett W. Thomas

This problem is motivated by the decision making that salespeople face in their daily work. We focus on a priori routing of representatives in health care industry such that the expected sales to doctors can be maximized. We investigate a series of formulations with increasing modeling detail of the stochastic elements. Our computational experiments identify the value of modeling stochasticity.

■ MC49

49- North 231 B- CC

Integrated Models for City Logistics

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Tom van Woensel, Professor of Freight Transport and Logistics, Eindhoven University of Technology, P.O. 513, Eindhoven, Netherlands, t.v.woensel@tue.nl

1 - Cyclic Distribution Strategies for an Inventory Routing Problem
Orsan Ozener, Ozyegin University, Department of Industrial Engineering, Istanbul, Turkey, orsan.ozener@ozyegin.edu.tr, Ali Ekici, Gultekin Kuyzu

We study a variant of inventory routing problem where a set of customers with deterministic and continuous demand is replenished from a central depot by routing a fleet of capacitated delivery vehicles. Assuming a cyclic distribution policy where the proposed delivery schedule is repeated with a given frequency, we propose three solution approaches and test them on a set of randomly generated instances in terms of solution quality and solution time.

2 - An Integrated Supply Chain Network Design Model with Expedited Delivery Options
Xiaopeng Li, Mississippi State University, P.O. Box 9546, 235L Walker Hall, 501 Hardy Road, Mississippi State, MS, 39762, United States of America, xli@cee.msstate.edu

We propose a network design model that integrates decisions in supplier location selection, customer assignments, transportation configurations, and inventory operations. This model particularly addresses tradeoffs between inventory expenses and expedited delivery usage and their dependence of location planning. A customized solution approach based on Lagrangian relaxation is proposed to efficiently solve this integer programming model with high nonlinearity.

3 - Developments and Challenges in City Logistics
Teodor Crainic, Professor, ESG UQAM and CIRRELT, Pavillon Andrè-Aisenstadt, 2920, chemin de la Tour, Montreal, QC, H3T 1J4, Canada, TeodorGabriel.Crainic@cirrelt.ca

We review recent developments and trends in the organization and business models for City Logistics as well as in models and methods proposed to address them. While significant progress may be observed, many challenging areas are still scarcely explored from an operations research perspective. We thus identify a number of research areas of major interest offering both significant scientific challenges and important impact potential.

4 - Integrating Freight and People in City Logistics
Tom van Woensel, Professor of Freight Transport and Logistics, Eindhoven University of Technology, P.O. 513, Eindhoven, Netherlands, t.v.woensel@tue.nl

Combining people and freight flows creates attractive business opportunities because the same transportation needs can be met with fewer vehicles and drivers. This paper will discuss the design of integrated people and freight transportation networks and the related coordination, planning and scheduling policies to enable efficient and reliable delivery of both persons and small- to medium-sized freight volumes.

■ MC50

50- North 231 C- CC

Military Decision Making

Sponsor: Military Applications

Sponsored Session

Chair: Chase Murray, Assistant Professor, Industrial & Systems Engineering, Auburn University, Auburn, AL, United States of America, ccm0022@auburn.edu

1 - Optimizing the Army's Aerial Reconnaissance and Surveillance Asset Mix

Jessica Tabacca, US Army TRADOC Analysis Center, White Sands Missile Range, Martin Luther King Drive, White Sands MR, NM, United States of America, emcrapar@nps.edu, Kirstin Smead, Emily Craparo

In an effort to preserve the Army's unmatched capabilities in aerial reconnaissance and surveillance (R&S), the Integrated Capabilities Development Team (ICDT) is supporting a large-scale study to determine in which R&S platforms and sensors the Army should invest. This presentation will discuss the Army's Joint Platform Allocation Tool (JPAT) methodology; key constraints, limitations, and assumptions; and the challenges overcome in developing the JPAT.

2 - Locating Monitors using Continuous- and Discrete-space Optimization Models

Andrew Romich, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, aromich222@gmail.com, J. Cole Smith, Guanghui Lan

The potential for an adversary to transport illicit material through an area of interest is a prevalent risk. In response to this threat, we examine the problem of placing stationary monitors in a continuous space to minimize an adversary's maximum probability of evasion. We first construct a two-stage MINLP. Then, we provide an algorithm to optimally locate the monitors in a continuous space and a heuristic that achieves a near-optimal bound utilizing a discretized set of monitor locations.

3 - A Nonconvex Nonlinear Assignment Problem for Multi-sensor Data Fusion

Dimitri Papageorgiou, PhD Candidate, Georgia Tech, 765 Ferst Ave., Atlanta, GA, 30332, United States of America, djpapag@gatech.edu

Multi-sensor data fusion hinges on the solution of a track-to-track association problem to determine the pairing of sensor-level tracks that correspond to the same true target from which the sensor-level tracks originated. After casting this problem as a MINLP, we use submodularity properties to solve this problem exactly within a branch-and-cut framework. Computational results illustrate the remarkable effectiveness of this approach.

■ MC51

51- North 232 A- CC

DIME/PMESII Modeling II

Sponsor: Military Applications

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - The Challenges Associated with Assessing Cyber Issues

Stuart Starr, Institute for Defense Analyses, 4850 Mark Center Drive, Alexandria, VA, 22311, United States of America, stuartstarr@cox.net, Dean Hartley

Recent cyber attacks have shown the challenges associated with assessing cyber issues. The assessment community is having a difficult time characterizing our current ability to assess cyber issues and prioritizing actions to improve that capability. We explore the state-of-the-art in our ability to assess cyber issues by decomposing the problem and identifying candidate cyber policy issues that warrant further analyses and identifies and illustrates candidate Measures of Merit (MoMs).

2 - A Methodology for Exploring Force Composition using the Peace Support Operations Model

Alejandro Hernandez, Associate Professor, Naval Postgraduate School, 777 Dyer Road, Monterey, CA, 93943, United States of America, ahernand@nps.edu, Mary McDonald, Julian Ouellet

We demonstrate a robust, repeatable methodology that addresses questions of force sufficiency (size, structure, capability). Though model-agnostic, this application employed the Peace Support Operations Model, recently used to support real-time planning in Afghanistan. We demonstrate a post-game analysis methodology that expands knowledge gained in a wargame, by evaluating additional courses of action as well as the robustness of decisions made given variations in the operational environment.

3 - The Foundations of Irregular Warfare (IW)

Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net, Lee Lacy

IW operations are hard: they connect to the human domain, where our knowledge is weak. Recent conflicts have produced demands for models of IW. Ontologies provide a tool for representing IW. They specify vocabularies & semantic relationships. We show ontologies of IW actor, action, & environment concepts and state variables. They come from several sources. The semantics permit programmatic inferencing. The ontologies are useful for modeling, data interchange, interoperability, and V&V.

■ MC52

52- North 232 B- CC

Models for Clean Electricity Systems

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Pedro Linares, Comillas P. University, Alberto Aguilera 25, Madrid, 28015, Spain, pedro.linares@upcomillas.es

1 - Influence of CO2 Cap and Trade Policy Parameters on Deregulated Electricity Networks

Felipe Feijoo, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, Fl, 33620, United States of America, felipefeijoo@mail.usf.edu, Tapas Das

Our game theoretic model analyzes the impact of design parameters of CO2 cap and trade policies on the performance of deregulated electricity networks. The performances include emissions, LMPs, consumption, generation and allowances allocation, and profits. We formulate the allowance and electricity markets as a bi-level continuous optimization problem and solve it using a MPEC/EPEC approach.

2 - Robust Wind Farm Layout Optimization with Mixed Integer Programming

Peter Y. Zhang, University of Toronto, 164 College Street, Toronto, ON, M5S 3G9, Canada, peteryun.zhang@mail.utoronto.ca, David Romero, Timothy Chan, Cristina Amon

Wind farm layout optimization aims to find the most profitable layout, given the site condition and the wind regime. However, the latter is inherently uncertain due to errors in measurement, correlation, and forecasting. Previous studies on wind farm optimization assumed wind data to be perfectly accurate, which could lead to lower investor confidence and higher financial risk. This study presents a novel Robust MIP model to address such gap.

3 - Generation and Storage Dispatch in Stochastic Electricity Networks

Lawrence V. Snyder, Associate Professor, Lehigh University, 200 West Packer Ave., Mohler Lab, Department of Industrial and Systems Engr, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu, Mohammadmohsen Moarefdoost, Gengyang Sun

We optimize generation and storage decisions in an electricity network with multiple generators, storage units, and loads under power flow constraints. The system faces either stochastic loads or supply disruptions. We solve the problems heuristically by decomposing them into several single-generator, single-battery, multi-load systems and solving them optimally using dynamic programming. We discuss our heuristic's computational performance as well as insights gained from the models.

4 - CGE Model for Clean Electricity Standards: Impacts on the U.S. Electric Power Sector

Ekundayo Shittu, Assistant Professor, Tulane University, 7 McAlister Dr., New Orleans, LA, 70118, United States of America, eshittu@tulane.edu, Ian Sue Wing

We develop a technology-detailed bottom-up CGE capacity expansion model with a macro-consistent calibration of activities via column disaggregation of the social accounting matrix. We address the congruency of technology substitution elasticity with clean electricity standards given a hybrid setting and EIA's generator pool mapping.

■ MC53

53- North 232 C- CC

Optimization Methods for Energy Efficiency and Risk Management

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Emilio L. Cano, University Rey Juan Carlos, Camino del Molino s/n, Edificio Biblioteca D007, Fuenlabrada, 28943, Spain, emilio.lopez@urjc.es

1 - Microgrid Modeling using the Stochastic Distributed Energy Resources Customer Adoption Model DER-CAM

Michael Stadler, Scientist, Lawrence Berkeley National Laboratory(USA), Center for Energy & Innovation(Austria), One Cyclotron Road, Berkeley (for Berkeley Lab), CA, United States of America, MStadler@lbl.gov, Mohammad Bozchalui, Afzal Siddiqui, Chris Marnay, Goncalo Cardoso, Markus Groissböck, Ratnesh Sharma

The Distributed Energy Resources Customer Adoption Model (DER-CAM) is a mixed integer linear optimization tool that has been designed by Berkeley Lab., USA and used in Australia, Austria, Germany, Portugal, Japan, and in China. It is also considered as basis for the European project Energy Efficiency and Risk Management in Public Buildings (EnRiMa). This presentation deals with the new stochastic programming features within DER-CAM, e.g. fuel cells or driving patterns for electric vehicles.

2 - Scenario Generation for Building Operations and Investment

Kjetil Midthun, SINTEF, Trondheim, Norway, Kjetil.Midthun@sintef.no, Adrian Tobias Werner, Michal Kaut

In a modern setting, consumers can take a more active role in controlling their energy usage. It is challenging to find efficient solutions in terms of economy and energy given the substantial uncertainty that are present both on the short-term and the long-term. Some of these uncertain parameters can be represented in scenario trees. We propose a scenario tree with a hybrid structure that address both long and short term uncertainty within the same framework.

3 - Analysis and Prediction of Aggregate Demand for Electricity

John Hobby, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, hobby@research.bell-labs.com, Gabriel Tucci, Mustafa Dogru

We analyze the aggregate electricity consumption of many consumers, and extract components for weather and natural illumination. Least-squares fits for Steadman apparent temperature and log-scale illumination proceed independently for each hour of the day. We use cubic polynomials and spline surfaces, with FFT spectral analysis for residual consumption. We do a full comparison with simpler methods based on exponential smoothing.

4 - A Symbolic Model Specification for Energy Efficiency Models

Emilio L. Cano, University Rey Juan Carlos, Camino del Molino s/n, Edificio Biblioteca D007, Fuenlabrada, 28943, Spain, emilio.lopez@urjc.es, Javier M. Moguerza

Within the framework of a Decision Support System for energy-efficient buildings, the dynamic generation of optimization models is advisable. The aim is to allow reproducibility and scalability, in order to cover a wide range of building configurations. In this work, an integrated model specification framework is presented. Within this scheme data structures comprising the model objects, and mathematical and digital representations are generated for both, human and machine interpretation.

■ MC54

54- Regency Ballroom A- Hyatt

Publishing in the INFORMS Journal on Computing

Cluster: INFORMS Journals Cluster

Invited Session

Chair: John Chinneck, Carleton University, Systems and Computer Engineering, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - How to Publish Your Paper in the INFORMS Journal on Computing

John Chinneck, Carleton University, Systems and Computer Engineering, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca, David L. Woodruff, Allen Holder, Edward Wasil, Karen Aardal, Subramanian Raghavan, Robert Fourer

What do we look for in evaluating a paper for publication in the INFORMS Journal on Computing? What are the characteristics of successful papers? How can you increase your chances of acceptance? What are the up-and-coming topics of interest? The Editor-in-Chief and senior editors will address these issues and answer your questions.

■ MC55

55- Regency Ballroom B - Hyatt

Joint Session OR in Emerging Econ/ENRE-Energy: OR Applications in the Energy Sector of Emerging Markets

Cluster: Operations Research in Emerging Economies & Energy, Natural Res & the Environment/Energy

Invited Session

Chair: Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, Sao Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br

1 - The Stochasticity of Brazilian Electric Sector

Fernando Luiz Cyrino Oliveira, Pontical Catholic University of Rio de Janeiro, Rua Marques São Vicente, 225, Gávea, Rio de Janeiro, RJ, 22451041, Brazil, fcyrino@ele.puc-rio.br, Pedro Guilherme Costa Ferreira, Reinaldo Castro Souza

This article aims at presenting a broad perspective of the Brazilian Electric sector, identifying the process of transformation through which it underwent during the last decades arriving at the Brazilian Electric Sector (BES) New Model. With this model it's shown how a good modeling of the stochastic variable is determinant to the good functioning of the BES' three fundamental pillars: planning, operation, and accounting and settlement process of the energy transactions in the short term market.

2 - Optimal Integration of Wind with Pumped Hydro Storage: Case Study of Kenya

Maureen Murage, Graduate Student, Cornell University, 321 Riley Robb Hall, Ithaca, NY, 14853, United States of America, mwm88@cornell.edu, Lindsay Anderson

Kenya is largely hydro-based, but has a growing interest in wind energy to meet the growing demand for electricity. Our objective is to develop an optimal control strategy to deploy paired wind and hydro resources to maximize generation reliability in the Kenyan power system. The benefits of this methodology will be illustrated using a case study based on Kenyan wind data.

3 - Macro-level Hybrid Energy Planning Model with Intermittent Renewable Sources -India Case Study

Ayse Selin Kocaman, Graduate Research Assistant, Columbia University, 500 West 120th Street, 918 S. W. Mudd Hall, New York, NY, 10027, United States of America, ask2170@columbia.edu, Tim Huh, Vijay Modi

Fast depleting fossils fuels and their environmental hazards increase the importance of renewable sources for sustainable energy planning. However, renewables are intermittent and heavily dependent on spatial location. Here, we address the problem of modeling hydro and solar energy production and allocation, including storage and long-term investments, capturing the uncertainty in the hourly supply and demand data. Model is applied to India which has significant solar and hydropower potential.

4 - How to Improve the Energy Sector in Developing Countries

Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mt Pleasant, MI, 48858, United States of America, shaha1s@cmich.edu

A country continual economic development requires energy. If a county is unable to provide enough, cheap energy, it could jeopardize its economic future. Operations Research has many techniques that can help develop efficient processes to improve productivity and reduce cost. The question is: does the availability of energy and cost effect economic growth and how can OR help? My paper will evaluate this question in the context of a few developing countries.

■ MC56

56- Curtis A- Hyatt

Joint Session TMS/ORG: Knowledge, Learning and Intellectual Capital

Sponsor: Technology Management & Organization Science

Sponsored Session

Chair: Charles Weber, Associate Professor of Eng & Tech Mgmnt, Portland State University, P.O. Box 751 ETM, Portland, OR, 97207, United States of America, webercm@gmail.com

1 - Knowledge Creation and Integration in Radical Product Innovation

Paulo Gomes, Visiting Assistant Professor, Babson College, TOIM, Babson Park, MA, United States of America, pgomes@babson.edu

We approach the product development process from a knowledge management perspective and examine practices at the product and process level that drive cohesiveness and integration. In particular, we try to understand how these practices facilitate or hinder new problems frames and product mental models for radical innovation. The paper reports on the results of an empirical study.

2 - Intellectual Property and Technology Start-ups: Size Matters

Kelvin Willoughby, Professor of Entrepreneurship & Intellectual Property, School of Electrical Engineering & Computing, Curtin University, GP.O. Box U1987, Perth, Wa, 6845, Australia, k.willoughby@curtin.edu.au

Intellectual property features more prominently in the business of small entrepreneurial technology firms than it does in the business of large mature technology firms. Results of an empirical study of bioscience-technology firms in the US reveal that the strategies of entrepreneurial technology firms incorporate a distinctive intellectual property portfolio management approach, rather than a crude patent administration approach, to appropriating value from their technology.

3 - Knowledge Work in Supply Chain Innovation Alliances: Technological Uncertainty as Inhibitor?

Ricarda Bouncken, Prof., University of Bayreuth, Prieserstr. 2, Bayreuth, 95444, Germany, bouncken@uni-bayreuth.de, Robin Pesch

Supply chain innovation alliances originally set up to improve effectiveness are today increasingly used for idea generation and new product creation. This study based on a sample of 418 firms delivers insights on how knowledge transfer and knowledge combination affect the joint knowledge creation and new product superiority in supply chain innovation alliances. We further provide insights how the knowledge work across supply chain partners is influenced by growing technological uncertainty.

4 - Synchronizing Knowledge Creation in a High Tech Manufacturing Ecosystem

Charles Weber, Associate Professor of Eng & Tech Mgmnt, Portland State University, P.O. Box 751 ETM, Portland, OR, 97207, United States of America, webercm@gmail.com, Jiting Yang

A qualitative empircal study of a high tech manufacturing ecosystem shows that the keystone of the ecosystem gains competitive advantage by entraining the whole ecosystem. Knowledge creation activities are synchronized on a global scale.

■ MC57

57- Curtis B- Hyatt

Markov Lecture (Keynote)

Sponsor: Applied Probability

Sponsored Session

Chair: Assaf Zeevi, Columbia Business School, New York, NY, United States of America, assaf@gsb.columbia.edu

1 - Stochastic Network Models for Hospital Inpatient Flow Management

J.G. "Jim" Dai, Professor, School of ORIE, Cornell University (on leave from Georgia Institute of Technology), 221 Rhodes Hall, 136 Hoy Road, Ithaca, NY, 14853, United States of America, jim.dai@cornell.edu

After being treated in ED, a patient's waiting time for admission to inpatient wards depends on time of the day, and can be excessively long when the patient's bed-request is in the morning. I will promote stochastic network models that are based on an extensive empirical study and present a two-time-scale approach to analyze these models. These analyses allow one to evaluate strategies such as inpatient discharge timing to flatten out the waiting time statistics throughout the day.

■ MC58

58- Phoenix East- Hyatt

New Directions in Game Theory and its Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu

Co-Chair: Omar Besbes, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu

1 - Delaying the Revelation of Information in a Social Learning Model

Kostas Bimpikis, Stanford University, Stanford, CA, United States of America, kostasb@stanford.edu, Kimon Drakopoulos

We study a model of strategic experimentation motivated by collective decision making with costly information acquisition or R&D and the innovation process. When the outcomes of experimentation are observable, free-riding results in inefficiently low experimentation. When an information aggregator holds all information and commits when to reveal it, efficiency increases.

2 - Equilibrium and Approximations for Repeated Auctions with Budgets Constraints

Santiago Balseiro, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, srb2155@columbia.edu, Omar Besbes, Gabriel Weintraub

We introduce the notion of a Fluid Mean Field Equilibrium (FMFE) to study the dynamic bidding strategies of budget-constrained agents in repeated second-price auctions. This concept combines a mean field approximation to relax the agents' informational requirements, with a fluid approximation to handle the dynamics of the agents' control problems. We show that a FMFE is computationally tractable, and that it approximates the rational behavior of agents in large markets.

3 - Mean Field Equilibria in Dynamic Auctions

Krishnamurthy Iyer, Stanford University, Stanford, CA, United States of America, kriyer@stanford.edu, Ramesh Johari

Recently, motivated by applications in electronic commerce, there has been a significant interest in the modeling and analysis of repetitions of simple auctions. Although standard techniques have not seemed promising, a large market approximation known as mean field equilibrium has been successful in characterizing bidder behavior and in market design. In this talk, we present an overview of the current results, and discuss new results for repeated common value auctions.

4 - An Internet Experiment on Bargaining in Networks

Yashodhan Kanoria, PhD Candidate, Stanford University, 350 Serra Mall, Stanford, CA, 94305, United States of America, ykanoria@stanford.edu, Cindy Chang, Andrea Montanari, Madison White

Exchange networks model the behavior of a set of players who need to reach pairwise agreements for mutual benefit, as in the labor market, the housing market and the 'market' for social relationships. We describe internet-based experiments on bargaining in networks, that are the largest such experiments to date. Our results include some of the first insights into the dynamics of bargaining.

■ MC59

59- Phoenix West- Hyatt

Multiclass Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Erjen Lefeber, Technische Universiteit Eindhoven, Eindhoven, 5600MB, Netherlands, A.A.J.Lefeber@tue.nl

1 - Transport Equation Models for Transient Production Flows

Dieter Armbruster, Professor, Arizona State University, Tempe, AZ, United States of America, armbruster@asu.edu, Matthew Wienke

Transient production flows, like e.g. recovery from failure, require to determine ensemble averages instead of time averages typical for stationary production. We show that coupled transport equation models for describing the time evolution and flow of work in progress and production speed along a production line are an effective way to study transient behavior. It is shown that the boundary conditions are the crucial modeling step connecting transient queueing theory and continuum models.

2 - Control of Multi-class Queueing Networks with Infinite Virtual Queues

Erjen Lefeber, Technische Universiteit Eindhoven, Eindhoven, 5600MB, Netherlands, A.A.J.Lefeber@tue.nl

We consider a generalization of the standard multi-class queueing network model by allowing both standard queues and infinite virtual queues which have infinite supply of work. We present a possible solution to the problem of finding policies which allow some of the nodes of the network to work with full utilization, and yet keep all the standard queues in the system stable.

3 - A Queue with Skill Based Service under FCFS-ALIS

Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, iadan@tue.nl, Gideon Weiss

We consider a queueing system with multi-type customers and multi-type servers, under FCFS-ALIS policy: A server always picks the first, longest waiting compatible customer, a customer is always assigned to the longest idle compatible server. We derive an explicit product-form expression for the steady state distribution, when service capacity is sufficient, and we also analyze the system under overload.

■ MC61

61- Russell- Hyatt

Joint Session AA/ SPPSN: Airline Scheduling under Competition and Collaboration

Sponsor: Aviation Applications & Public Programs, Service and Needs

Sponsored Session

Chair: Luis Cadarso, Technical University of Madrid, Aeronautics School, Pza. Cardenal Cisneros, 3, Madrid, 28040, Spain, luis.cadarso@upm.es

1 - Revenue and Operational Impacts of Depeaking Flights at Hub Airports

Laurie Garrow, Associate Professor, Georgia Institute of Technology, School of Civil Engineering, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu, Donald Katz

Many US airlines have converted their hub airport schedules from having several flight banks a day to a depeaked continuous schedule. This study assess revenue and operational impacts associated with depeaking flights. By recreating airline schedules and determining how much each airline depeaked and which flights were shifted away from the banks, the lost connections will be assessed as to whether the depeaking strategy was beneficial for the airline and airport.

2 - A Consensus-building Mechanism for Setting Service Expectations in Air Traffic Flow Management

Prem Swaroop, PhD Candidate, Robert H Smith School of Business, University of Maryland, 3330C, Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, pswaroop@rhsmith.umd.edu, Michael Ball

We develop a voting-based mechanism for airlines to provide strategic input to the Air Navigation Service Provider. This involves some interesting problems and technologies — largely: voting, optimization models, integer programming and column-generation, multi-attribute valuation models. Through large experiments, we have shown that the proposed mechanism is fairly robust and has promise in addressing the stated problem.

3 - Codesharing Types and Liberalization Agreements: Effects on Frequency and Pricing

Nicole Adler, Hebrew University of Jerusalem, Mount Scopus, Jerusalem, 91905, Israel, msnic@huji.ac.il, Benny Mantin

Governments sign liberalization agreements to regulate the airborne traffic between two countries, whereas airlines engage in codeshare contracts to set the level of coordination and pooling of resources. Empirically studying their effects on international non-stop routes, we find that the level of liberalization has a significant impact on frequency, and that 'free sale' contracts decrease airfares whereas 'block' codeshares have the opposite effect.

4 - Airline Scheduling in Competitive Markets

Luis Cadarso, Technical University of Madrid, Aeronautics School, Pza. Cardenal Cisneros, 3, Madrid, 28040, Spain, luis.cadarso@upm.es, Cynthia Barnhart, Virot Chiraphadhanakul, Angel Marín, Vikrant Vaze

We define competitive markets as those where more than one operator such as airlines and high speed trains operate. We develop a mixed-integer linear optimization model in order to determine an optimal flight schedule and fleet assignment for an airline operating in competitive markets. The market share is estimated by a piecewise linear approximation of the logistic curve. The objective is to maximize airline profitability. We assume that the strategy from the rest of operators is known. An application of the model for a simplified IBERIA (the major Spanish airline) network is shown.

■ MC62

62- Borein A- Hyatt

Market Mechanisms and their Applications

Cluster: Auctions

Invited Session

Chair: Tunay Tunca, Associate Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ttunca@rhsmith.umd.edu

1 - The Use of Optimization to Assist the FCC in a Reverse Auction to Buy Back TV Spectrum

Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, 4400 University Drive, Fairfax, VA, 22030, United States of America, khoffman@gmu.edu, Tony Coudert, Dinesh Menon, Rudy Sultana

This reverse auction is completely voluntary and the broadcasters who do not participate or whose bids are not accepted will be repacked into the remaining reduced TV channels. Bidding options include giving up a license to broadcast over-the-air, sharing the 6-MHz channel with another station, or going from a UHF channel to a VHF channel. This talk will describe the optimization modeling that seeks to minimize the buy-back costs while satisfying interference restrictions.

2 - Optimal Allocation of Local Exclusivity Rights

Changrong Deng, Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC, United States of America, changrong.deng@duke.edu, Sasa Pekec

Multiple identical items are being sold to unit-demand buyers in a network. Buyers are willing to pay a premium if they obtain the item exclusively in their neighborhood. We solve the revenue maximizing mechanism design problem for locally linear exclusivity valuations. We discuss the complexity of the problem and the non-monotonicity of the optimal seller revenues in buyers' valuations. We also present an ascending auction implementation of the optimal mechanism for the clique.

3 - Managing Air Traffic Disruptions through Strategic Prioritization

Ian Kash, Microsoft Research, 7 J J Thomson Ave., Cambridge, CB3 0FB, United Kingdom, iankash@microsoft.com, Douglas Fearing

The current approach for allocating air traffic delays treats flights equivalently regardless of aircraft size, passenger load, etc. We show that significant benefits can be achieved by allowing prioritization. We develop a non-monetary, auction-based scheme for allocating flight priorities which allows airlines to trade-off priorities across airports. In addition to having nice equilibrium properties, our bidding scheme is capable of achieving some of the benefits of congestion pricing.

4 - Optimizing Kidney Exchange with Transplant Chains: Theory and Reality

John Dickerson, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, dickerson@cs.cmu.edu, Tuomas Sandholm, Ariel Procaccia

Chains, sequences of transplants initiated by an altruistic donor, have shown marked success in kidney exchanges. We prove that chains beyond length 3 do not help in the large. Yet our results from running the UNOS nationwide exchange show improvement with caps up to 13. We analyze reasons for this. We augment the standard model to include various real-world features. Experiments support the theory and help determine what is "in the large". In the dynamic setting, a cap of 4 is better than 5.

■ MC63

63- Borein B- Hyatt

Behavioral Issues in Supply Chain and Channel Management

Sponsor: Behavioral Operations

Sponsored Session

Chair: Kay-Yut Chen, Principal Scientist, HP Labs, 1U-2, HP Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com

1 - Repeated Distributive Negotiations: How Expectations of Future Transactions Impact Present Behaviors

Haresh Gurnani, Professor, University of Miami, Dept. of Management, Coral Gables, FL, 33124, United States of America, hgurnani@bus.miami.edu, Rajesh Bagchi, Shweta Oza, Mahesh Nagarajan

We study repeat distributive negotiations to analyze how negotiator's role (buyer vs. seller) and expectation of role reversal in future affects current negotiation. Implications for supply chains are discussed. In three studies we find that with role reversal, transactions are coupled with greater concessions now in anticipation of future recovery. With role reversal, negotiators believe that opponents will make larger concessions in future as they feel that the negotiator would do the same.

2 - From Clicks to Bricks and Back Again

Julie Niederhoff, Syracuse University, Syracuse, NY, United States of America, jniederh@syr.edu, Almula Camdereli, Dennis Yu

In this paper we propose a model where stores offer to order the item into the local brick-and-mortar store for customer preview at no risk to the customer with a demand-based preview stocking policy. In this behavioral study, subjects are presented with a small choice set but they can incur some waiting time to see the larger set. The measures of satisfaction, willingness to pay for their ideal item, and commitment to the ideal item provide insight into the new online/in-store hybrid option.

3 - Decision Makings under Economic Order Quantity Settings

Diana Wu, University of Kansas, Lawrence, KS, United States of America, dianawu@ku.edu, Kay-Yut Chen

In this paper, we study ordering behavior under the EOQ setting. We find subjects error even under deterministic demand. Moreover, we find how demand and cost information is "framed" to subjects affects their decisions. A behavioral model that considers bounded rationality and framing effect is proposed to explain the observations.

4 - Complexity as a Contract Design Factor: A Human-to-human Experimental Study

Feryal Erhun, Stanford University, Stanford, CA, United States of America, ferhun@stanford.edu, Basak Kalkanci, Kay-Yut Chen

Our goal is to identify why simpler contracts may be preferred in practice despite being theoretically suboptimal using a human supplier-human buyer (H2H) experimental setting. We extend Kalkanci, Chen, and Erhun's (2011) (KCE) human supplier-computerized buyer results and show H2H interactions strengthen suppliers' preference for simpler contracts. KCE identified reinforcement and bounded rationality as key decision biases. In H2H experiments, we find evidence for social preference effects.

■ MC66

66- Ellis West- Hyatt

Decision Making and Planning: Methods and Applications

Sponsor: Data Mining

Sponsored Session

Chair: Shouyi Wang, University of Washington, 3311 NE 65TH Street, Seattle, WA, 98115, United States of America, shouyi@uw.edu

1 - Product Assortment Decisions for a Network of Retail Stores using Data Mining with Optimization

Fidan Boylu, University of Connecticut, One University Pl, Stamford, CT, 07020, United States of America, fidan.boylu@business.uconn.edu

We present a model for product assortment optimization for a network of retail stores operating in various locations. We combine local information captured from each retail store and deploy a global frequent itemset analysis based on association rule mining. We solve a network optimization model to find which products to include in a store's assortment and which stores to ship from. We use the transactional level data from a leading plastics manufacturer and retailer in the United States.

2 - ERP and the Myth of Collaboration in Supply Chains: A Cloud Based Planning Alternative

Suri Gurumurthi, Visiting Assistant Professor, University of Illinois, Urbana-Champaign, 350 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, surig@illinois.edu

Enterprise planning frameworks reveal several shortcomings when used for collaborative planning in product development, or production planning contexts. Current day planning algorithms – designed for integrated databases, and to centralize key decision-making, provide limited visibility and risk management capabilities when coordinating decision-making across firms. We provide a cloud based framework and associated algorithms for collaborative planning of capacity in a supply chain.

3 - Generalizing Sequential Sampling Experiments

Dashi Singham, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, dsingham@nps.edu

The sampling decision is crucial to the success of any simulation experiment. More samples imply better confidence and precision in the results, but require higher costs. A sequential confidence interval procedure can be used to determine when to stop collecting samples. We present a general framework for analyzing sequential rules and assessing their quality. Solutions for managing the tradeoff between improved coverage and replications costs are provided.

4 - Online Monitoring and Prediction of Complex Time Series Events

Shouyi Wang, University of Washington, 3311 NE 65TH Street, Seattle, WA, 98115, United States of America, shouyi@uw.edu, Art Chaovalitwongse

This talk presents a new general framework for online monitoring and prediction of complex time series events from nonstationary and chaotic time series data. The proposed prediction approach adapts and innovates data mining and adaptive learning concepts to analyze time series data, and creates a set of innovative analysis methods to reveal hidden temporal patterns that are characteristic and predictive of time series events.

■ MC67

67- Ellis East- Hyatt

Joint Session QSR/ENRE: Panel Discussion: Reliability and Stochasticity in Renewable Power Systems

Sponsor: Quality, Statistics and Reliability & Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Eunshin Byon, Assistant Professor, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ebyon@umich.edu

1 - Panel Discussion: Reliability and Stochasticity in Renewable Power Systems

Moderator: Eunshin Byon, Assistant Professor, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ebyon@umich.edu, Panelists: Shmuel Oren, David Coit, Yu Ding, Nagi Gebraeel, Shuangwen Sheng

Renewable energy systems pose significant challenges for planning and operations due to the stochastic nature. In this panel discussion, the panelists will share their experiences and highlight research problems that need to be addressed in future. The panelists are: Dr. Oren at University of California at Berkeley; Dr. Coit at Rutgers University; Dr. Ding at Texas A&M University; Dr. Gebraeel at Georgia Institute of Technology, Senior Engineer Dr. Sheng at National Renewable Energy Laboratory.

■ MC68

68- Suite 312- Hyatt

Tutorials in Financial Services

Sponsor: Financial Services Section

Sponsored Session

Chair: Jim Bander, National Manager, Decision Sciences/Risk Management, Toyota Financial Services, 3200 W Ray Rd, Chandler, AZ, 85226, United States of America, jim.bander@gmail.com

1 - Risk Management for Pension Funds

Prashant Pai, SAS Institute, SAS Campus Drive, Cary, NC, 27513, United States of America, Prashant.Pai@sas.com

This tutorial outlines the Risk Management practice for a typical Pension Fund manager. Topics discussed include Composition Analysis, Benchmarks, Exposure Buckets, Marginal and Component Risk, Return and Risk Contribution, Tracking Error, Ex-ante and Ex-post measures, Duration and Convexity, Value at Risk, Brinson Method for return based attribution, multi-factor Risk and Return attribution, and Stress Tests. Sample Reports that are used for Risk Management will be illustrated.

2 - Tutorial: Analytics in Consumer Credit

Jim Bander, National Manager, Decision Sciences/Risk Management, Toyota Financial Services, 3200 W Ray Rd, Chandler, AZ, 85226, United States of America, jim.bander@gmail.com

A practitioner discusses current issues in consumer lending with the objective of sparking research ideas that can be applied in the field. The talk will review the state of the practice in credit, collateral, and fraud risk analytics. Specific applications including pricing, servicing, and collections optimization.

■ MC69

69- Suite 314- Hyatt

Financial Optimization Methods in Energy Markets

Cluster: Optimization in Finance

Invited Session

Chair: Kumar Muthuraman, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, United States of America, kumar@austin.utexas.edu

1 - Commodity Storage Valuation

Kumar Muthuraman, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, United States of America, kumar@austin.utexas.edu, Stathis Tompaidis

We present a general valuation framework for commodity storage facilities, for non-perishable commodities. We consider the case of a storage facility small enough so that injections and withdrawals do not influence the price of the underlying commodity. We allow for mean-reversion and seasonality in the price of the commodity, and allow for injection and withdrawal costs. To find the optimal actions for the storage owner we present an iterative numerical algorithm and prove its convergence.

2 - Generation Capacity Expansion in Electricity Markets under Rivalry and Uncertainty

Michail Chronopoulos, University College London, Gower Street, London, United Kingdom, m.chronopoulos@ucl.ac.uk, Derek Bunn, Bert De Reyck, Afzal Siddiqui

We explore electricity capacity expansion by accounting for not only dependency between the cash flows of competing technologies but also competition. Although market equilibrium can be determined analytically in stylised real options models, in a more general setting with asymmetric costs and capacity restrictions, analytical solution of a system of equations is not possible. Since a convex programming approach cannot be implemented, complementarity problems provide a viable modelling approach.

3 - Electricity Price Spike Prediction via Boosting Trees and Wavelet Analysis

Shijie Deng, Associate Professor, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States of America, deng@gatech.edu, Xiaoming Huo, Yibiao Lu

We present a novel approach, which combines nondecimated wavelet transform with the boosting trees method, to model energy prices for detecting and predicting price spikes. Intuitive and mathematical description of the methodology is provided. The case studies on Australia electricity markets (both Queenland and New South wales) show enhanced prediction accuracy and lowered false alarm rate than those of existing methods in the literature.

■ MC70

70- Suite 316- Hyatt

Optimizing Release Strategies for Open Source Software, Coordinating Online Marketplaces, and Designing for the Cloud

Sponsor: Information Systems

Sponsored Session

Chair: Terrence August, University of California-San Diego, Rady School of Management, 9500 Gilman Dr, MC 0553, La Jolla, CA, United States of America, taugust@ucsd.edu

1 - "Release Early, Release Often"? An Empirical Analysis of Release Strategy in Open Source Software

Wei Chen, University of California, San Diego, Rady School of Management, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, wei.chen@rady.ucsd.edu, Vish Krishnan, Kevin Zhu

"Release early, release often" has become a mantra in open source software (OSS). We study the impact of release strategies on the download performance of OSS projects. Using a panel data collected from Sourceforge.net, we find that release frequency has a curvilinear relationship with download performance. We also find that adoption cost and community contribution moderate the effect of release strategy. We explore the implications of our findings for the theory and practice of OSS management.

2 - Not all Cloud Users are Equal: Who Benefits from Technical Support?

German Retana, PhD Candidate, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, german.retana@mgt.gatech.edu, Chris Forman, Sridhar Narasimhan, Marius Florin Niculescu, D.J. Wu

Based on an analysis of firm-level data on cloud infrastructure services usage, we examine how customer-level attributes moderate the effects of support on customer demand for the service. We find, for example, that the younger customers are, the stronger the positive effect that adopting higher levels of support has on their demand for IT capacity and on their ability to employ the advanced features of the cloud.

3 - Competition and Coordination in Online Marketplaces

Daewon Sun, University of Notre Dame, 359 MCOB, Notre Dame, IN, United States of America, dsun@nd.edu, Jennifer Ryan, Xuying Zhao

Online market places, such as those operated by Amazon, eBay and Google, serve as an intermediary, providing the service of matching buyers with sellers, while control of the good is left to the seller. We study a new form of channel conflict caused by online marketplace systems.

4 - Cloud Computing: Implications on Software Network Structure and Security Risks

Terrence August, University of California-San Diego, Rady School of Management, 9500 Gilman Dr, MC 0553, La Jolla, CA, United States of America, taugust@ucsd.edu, Marius Florin Niculescu, Hyo duk Shin

By software vendors offering, via the cloud, software as a service (SaaS) versions of traditionally on-premises products, security risks associated with software usage become more diversified which can greatly increase the value associated with network software. In an environment where negative security externalities are present and users make complex consumption and patching decisions, we construct a model that clarifies whether and how SaaS versions should be offered by vendors.

■ MC71

71- Suite 318- Hyatt

eServices

Sponsor: eBusiness

Sponsored Session

Chair: Atanu Lahiri, University of Washington, Box 353226, Seattle, WA, United States of America, lahiria@uw.edu

1 - Competition Dynamics in Cloud Computing Market

Hossein Ghasemkhani, PhD Candidate, University of Washington, Foster School of Business, Seattle, WA, United States of America, hossein@uw.edu, Yong Tan

We analyze the dynamic competition of forward-looking cloud computing providers using a differential game model with rate of capacity provision as the control variable. We derive the long-run stationary equilibrium and analyze the short-run strategies of the firms. We posit that although initial market shares do not affect the steady-state outcomes, initial capacities, budgets and cost of capacity provision are all important in determining the steady-state market structure and long-run profits.

2 - How Keen are the Payers in Promoting Telemedicine – Incentives for the Insurers

Balaraman Rajan, Simon School of Business, University of Rochester, CS 4-339, Carol Simon, Rochester, NY, 14627, United States of America, balaraman.rajan@Simon.Rochester.edu

The adoption of telemedicine especially for the case of chronic disease management has been surprisingly slow. We use a markovian model to analyze the incentives for the payers in promoting telemedicine. While continuous disease management could reduce complications and help in preventive care, for the payor what might matter is the cumulative lifetime cost of a patient. The key to telemedicine is in an innovative payment system where the actual beneficiaries pay for the innovative practice.

3 - Allocating Shared Resources Optimally for Call Center Operations and Knowledge Management Activities

Abhijeet Ghosal, University of Minnesota, Minneapolis, MN, United States of America, abhijeet@umn.edu, Mani Subramani, Alok Gupta

We study a problem where a call center should optimally allocate available resources to call handling and document creation tasks. The call center resolves on phone problems that engineers face in the field. Often when an engineer calls, he/she has to wait in a queue. To avoid this situation, documents discussing commonly occurring problems are published at a knowledge repository. The allocation of resources should be determined so that the average waiting time in the queue is minimized.

■ MC72

72- Suite 322- Hyatt

Approximate Dynamic Programming in Resource Allocation

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Marek Petrik, Research Staff Member, IBM Research, 1101 Kitchawan Rd, Rte 134, Yorktown Heights, NY, 10598, United States of America, mpetrik@us.ibm.com

1 - A Joint Location-inventory-Transshipment Problem

Oleksandr Shlakhter, University of Toronto, Joseph L. Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, alex.shlakhter@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

We consider a location-inventory-transshipment problem in a supply chain, which consists of one supplier, multiple retailers and multiple customers. The chain is coordinated through replenishment, customers allocation, and transshipments between retailers. The problem is to determine location of retailers, replenishment and transshipment policies, and allocation of customers to minimize the expected average cost. We show that the problem can be solved using a sample-path-based algorithm.

2 - An Approximate Dynamic Programming Method for Scheduling of a Chemotherapy Infusion Center

Timothy Hopper, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, tdhopper@ncsu.edu

Chemotherapy infusion clinics can have fifty or more chairs where patients come to receive one-to-eight hour treatments. Uncertainty in treatment durations, and nurse availability, makes real time appointment scheduling decisions a challenge. We formulate a stochastic dynamic programming model for this problem and we compare approximate dynamic programming methods for solving this problem. Results are presented based on empirical data from a large cancer hospital.

3 - Scheduling Capacitated Re-entrant Lines through Approximate Dynamic Programming

Spyros Reveliotis, Professor, Georgia Institute of Technology, ISyE, 765 Ferst Dr., Atlanta, GA, 30332, United States of America, spyros.reveliotis@isye.gatech.edu

We consider the problem of throughput maximization of re-entrant lines with finite buffering capacity at the line workstations. The presence of finite buffers gives rise to blocking effects that negate well known results concerning the throughput-optimal scheduling of re-entrant lines with infinite buffering capacity. We will present an approximate policy iteration scheme for the resulting scheduling problem that is based on a feature-based aggregation of the underlying state space.

4 - Demand Shaping by Approximate Dynamic Programming

Marek Petrik, Research Staff Member, IBM Research, 1101 Kitchawan Rd, Rte 134, Yorktown Heights, NY, 10598, United States of America, mpetrik@us.ibm.com, Dharmashankar Subramanian

We propose a method for balancing supply and demand using customer incentives to buy alternative products. The inventory is computed using approximate dynamic programming given the uncertain future demands. It is common to approximate the value function using piecewise linear separable functions, but this approach fails to capture inter-product dependence. We propose and analyze a new method for constructing features using problem structure and demonstrate its utility in this domain.

■ MC73

73- Suite 324- Hyatt

Portfolio Credit Risk

Cluster: Quantitative Finance

Invited Session

Chair: Rafael Mendoza, Assistant Professor, McCombs School of Business, 1 University Station, CBA 5.202, B6500, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu

1 - Risk Premia and Optimal Liquidation of Defaultable Securities

Tim Siu-Tang Leung, Columbia University, New York, NY, United States of America, leung@ieor.columbia.edu, Peng Liu

We study the optimal timing to liquidate defaultable securities in a general intensity-based credit risk model under stochastic interest rate. The model incorporates the potential price discrepancy between the market and investors under different default risk premia specifications. We introduce the delayed liquidation premium and analyze the optimal liquidation policy for various credit derivatives.

2 - Dynamic Modeling of Portfolio Credit Risk with Common Shocks

Tomasz Bielecki, Professor, Applied Mathematics Department, Illinois Institute of Technology, 10 W 32nd Street, E1 Bldg, Chicago, IL, 60616, United States of America, bielecki@iit.edu, Stephane Crepey, Areski Cousin, Alexander Herbertsson

We consider a bottom-up Markovian copula model of portfolio credit risk where dependence among credit names stems from the possibility of simultaneous defaults. Calibration of marginals and dependence parameters can be performed separately using a two-steps procedure, much like in a standard static copula set-up. As a result this model allows us to hedge CDO tranches using single-name CDS-s in a theoretically sound and practically convenient way.

3 - Positive Subordinate Jump-CIR Processes with Two-Sided Mean-Reverting Jumps

Rafael Mendoza, Assistant Professor, McCombs School of Business, 1 University Station, CBA 5.202, B6500, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu

In this paper we present the SubJCIR jump-diffusion process. The SubJCIR's jump component includes two-sided mean-reverting (state-dependent) jumps. The process remains strictly positive if the CIR process satisfies Feller's condition. The analytical tractability of the SubJCIR process makes it a richer extension to the JCIR process (compared to previous models) and it is also a natural alternative for interest rates and credit models.

4 - Variance Swaps on Levy Subordinated Diffusions
Matthew Lorig, Postdoctoral Researcher, Department of Operations Research and Financial Engineering, Princeton University, Sherrerd Hall, Charlton Street, Princeton, NJ, 08544, United States of America, mlorig@princeton.edu, Rafael Mendoza

We compute the value of a variance swap when the underlying is modeled as a Levy subordinated diffusion process. The underlying in this framework may exhibit jumps with a state-dependent Levy measure, as well as local stochastic volatility and default intensity. Moreover, the Levy subordinator can be obtained directly from European call/put prices.

Monday, 4:30pm - 6:00pm

■ MD01

01- West 101- CC

Convexification Techniques in MINLP

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, University of Florida, Department of Industrial and Systems, Engineering 303 Weil Hall, Gainesville, FL, 32608, United States of America, richard@ise.ufl.edu

1 - Solving Mixed Integer Polynomial Optimization Problems with MINOTAUR
Jeff Linderoth, Professor, University of Wisconsin-Madison, 3270 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53715, United States of America, linderoth@wisc.edu, James Luedtke, Ashutosh Mahajan, Mahdi Namazifar

We study methods for building polyhedral relaxations of multilinear terms that arise in nonconvex mixed integer optimization problems. We present computational results for an approach based on grouping the variables into subsets that cover all multilinear terms in the problem. The approach is combined with additional reformulation techniques and spatial branching in the software framework MINOTAUR to produce a solver for mixed integer polynomial optimization problems.

2 - Representability of Disjunctive Cuts for Mixed-integer Nonlinear Programming
Sina Modaresi, University of Pittsburgh, 3700 O'Hara Street, Pittsburgh, United States of America, sim23@pitt.edu, Mustafa Kilinc, Juan Pablo Vielma

Consider the problem of finding the convex hull of the union of disjunctive nonlinear sets. In many cases there are extended formulations for the convex hull; however, it is not clear if the projection of such formulations belongs to the same class as the original sets. We show that for some classes of sets, the convex hull of the union of two disjunctive nonlinear sets belongs to the same class as the original sets.

3 - Global Optimization of Nonconvex Problems with Multilinear Intermediates
Aida Khajavirad, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, aida@cmu.edu, Nick Sahinidis, Mohit Tawarmalani, Xiaowie Bao

We consider global optimization of problems containing multilinears. It is known that the facets of the convex hull of a multilinear on a box can be obtained by solving an LP. However, the size of this LP grows exponentially with the number of variables. We propose a decomposition scheme to decompose a multilinear to low dimensional components, for which this LP can be solved efficiently. We embed this cut generation strategy at every node of BARON, and present results on variety of problems.

4 - RLT-POS: Reformulation-Linearization Technique-based Optimization Software for Polynomial Programs
Evrim Dalkiran, Assistant Professor, Wayne State University, 4815 4th St Manufacturing Eng., Detroit Mi 48202, United States of America, evrimd@wayne.edu, Hanif D. Sherali

And the abstract is as follows: "We introduce a Reformulation-Linearization Technique (RLT)-based open-source optimization software for solving polynomial programs (RLT-POS). We start with presenting algorithms that form the backbone of RLT-POS. Next, we discuss the coordination between (a) bound-grid-factor constraints and semidefinite cuts and (b) constraint filtering techniques and reduced RLT representations. Finally, we compare the performances of the software packages BARON, SparsePOP, and Couenne with RLT-POS.

■ MD02

02- West 102 A- CC

Decision Analysis Society Awards

Sponsor: Decision Analysis

Sponsored Session

Chair: Vicki Bier, Professor, University of Wisconsin, 1513 University Avenue, Room 3270A, Madison, WI, 53706, United States of America, bier@engr.wisc.edu

1 - 2012 Decision Analysis Student Paper Award
Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Lea Deleris

We will announce the winner and the finalist of the 2012 Decision Analysis Student Paper Award. The winner will provide a short presentation. Everyone is welcome to attend!!

2 - 2012 DAS Practice Award
Gregory Parnell, United States Military Academy, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu

The DAS Publications Award will be presented for the best paper published in 2010. This year's winners are Samuel Bond, Kurt Carlson, and Ralph Keeney, authors of "Improving the Generation of Decision Objectives", Decision Analysis, vol. 7, pp. 238-55, September 2010.

3 - Ramsey Medal Award
Detlof von Winterfeldt, Professor, University of Souther California, RTH 312, 3710 McClintock Ave., Los Angeles, CA, 92651, United States of America, detlof@aol.com

The Ramsey Medal of the Decision Analysis Society is awarded for distinguished contributions in decision analysis. Distinguished contributions can be internal, such as theoretical and procedural advances in decision analysis, or external, such as developing or spreading decision analysis in new fields. We will introduce the 2012 Ramsey Medal winner, followed by a presentation by the winner. This year's winner is Robert Clemen, Professor Emeritus of Decision Sciences at Duke University.

4 - Decision Analysis Publication Award
Jason Merrick, Professor, Virginia Commonwealth University, Statistics & Operations Research, P.O. Box 843083, Richmond, VA, 23284, United States of America, jrmerric@vcu.edu, Ali Abbas, Robin Keller

This award is given annually to the best decision analysis article or book published in the second preceding calendar year (i.e. calendar year 2010 for consideration in 2012). The intent of the award is to recognize the best publication in "decision analysis, broadly defined." This includes, but is not limited to, theoretical work on decision analysis methodology (including behavioral decision making and non-expected utility theory), descriptions of applications, and experimental studies.

■ MD03

03- West 102 B- CC

Applied Decision Analysis II

Contributed Session

Chair: Baichun Feng, The University of Memphis, 4510 N Wilson Dr Apt 1, Shorewood, WI, 53211, United States of America, flemns@hotmail.com

1 - A Decision on Increasing Recycling Rate of Waste Desktops in Taiwan by Bi-Level Programming
Ya-Ju Hsu, Grad. Inst. of Manag. Sci., Tamkang University, 151 Yingzhuan Rd., New Taipei, 25137, Taiwan-ROC, 600620081@s00.tku.edu.tw, Hsu-Shih Shih, Po-Hsien Hsu

This study analyzes the means of increasing the recycling rate of waste PCs in Taiwan through bilevel programming. The upper-level is the social welfare system; the lower-level is the recycling industries. The traditional and fuzzy approaches are used to solve the problem. The result shows the collecting fee being significant.

2 - Multiple Criteria Supplier Selection based on Artificial Intelligence

Baichun Feng, The University of Memphis, 4510 N Wilson Dr., Apt. 1, Shorewood, WI, 53211, United States of America, flemns@hotmail.com

This research proposes an approach to solve the multiple criteria supplier selection problem. This approach can take the advantage of the past supplier selection data and adapt itself in a way that it learn the decision maker's nonlinear preference information from the past data. A numerical example is used to demonstrate that this approach is very effective in handling the multiple criteria supplier selection problem.

3 - An Examination of Evolved Behavior in Two Reinforcement Learning Systems

Ram Pakath, Professor, University of Kentucky, Decision Science & Information Systems, 425 C.M. Gatton College of Business & Ec, Lexington, KY, 40506-0034, United States of America, pakath@gmail.com, David Gaines

We assess the relative performance of two reinforcement learning paradigms – the Learning Classifier System and the Extended Classifier System – in the context of playing the Iterated Prisoner's Dilemma game. The XCS is a considerably stronger performer in previous experimental settings. Our application allows us to assess their abilities to: (a) evolve irrational behavior, (b) cope with a multi-step test environment, (c) handle uncertainty, and (d) cope with asymmetric knowledge-base updates.

■ MD04

04- West 102 C- CC

Applications of the Analytical Network Process (ANP)

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Orrin Cooper, Assistant Professor, University of Memphis, Fogelman College of Business & Economics, Memphis, TN, United States of America, olcooper@memphis.edu

1 - Applying the Analytic Hierarchy Process to Ethical Decision Making

Donald Adolphson, Professor, Brigham Young University, Romney Institute of Public Management, 764 TNRB, Provo, UT, 84602, United States of America, donald_adolphson@byu.edu, Orrin Cooper, Jared Harris

An often overlooked arena for OR tools is in moral & ethical decision making. The use of relative scales in Saaty's AHP is especially useful in this regard, because it provides a way to quantify things which cannot be easily measured. The fundamental concept in ethical decision making is Stakeholder Analysis. We will argue in this paper that the AHP can serve a vital role in gaining the understanding of stakeholder interests required to find the sought after joint interests.

2 - Does the Analytic Hierarchy Process (AHP) Measure Intensity of Preferences?

Gabriela M. Sava, PhD Student, Joseph M. Katz Graduate School of Business, University of Pittsburgh, 241 Mervis Hall, Pittsburgh, PA, 15260, United States of America, mgsava@katz.pitt.edu, Luis G. Vargas

The AHP is a decision-making method based on pairwise comparisons from an absolute scale. In this paper we construct two experiments to compare consumers' preferences for a good described by a single stimulus-response function. The results show that the AHP and the trade-offs made using the stimulus-response function are in agreement on how strongly consumers prefer the good. This provides support for the hypothesis that the AHP measures intensity of preferences.

3 - A Hybrid Performance Analysis Approach to Grafting Process Design using Simulation and Fuzzy AHP

Chao Meng, The University of Arizona, 1127 E James E Rogers Way, P.O. Box 210020, Tucson, AZ, 85721, United States of America, meng5656@gmail.com, Dong Xu, Young-Jun Son

A hybrid performance analysis approach integrating discrete event simulation, system dynamics and fuzzy analytic hierarchy process (AHP) is proposed to evaluate grafting process designs. Grafting process and grafted seedling supply chain are simulated to assess the performance of grafting process designs in terms of profit, production flexibility and resource utilization. Fuzzy AHP addresses a multi-objective problem given the performance results and determines the best grafting process designs.

4 - Cluster Comparison Weights in ANP Models that are Dependent on the Alternatives

Orrin Cooper, Assistant Professor, University of Memphis, Fogelman College of Business & Economics, Memphis, TN, United States of America, olcooper@memphis.edu, Guoqing Liu

The criteria weights or influence in an ANP model can be either independent of the alternatives like for school admissions or dependent on the alternatives like in a market share model. When the criteria are dependent on the alternatives the cluster comparisons are also dependent on the alternatives and must be made individually for each alternative in order to avoid bogus results. These results hold for both tangibles and intangibles. A simple example with the solution is presented herein.

■ MD05

05- West 103 A- CC

Advance in Modeling Massive Data

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Xinwei Deng, Assistant Professor, Virginia Tech, 406 Hutcheson Hall, Blacksburg, VA, 24061, United States of America, xdeng@vt.edu

1 - Bayesian Variable Selection for Computer Experiments

Ying Hung, Assistant Professor, Department of Statistics, Rutgers University, 110 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, yhung@stat.rutgers.edu, Xinwei Deng

Identifying inputs that significantly impact a complex system is a critical step in computer experiments. Such active factors can be further used to improve model accuracy. In this work, we propose a new and unified Bayesian framework to identify active factors. This framework is based on a widely used Gaussian process model and a novel approximation to simplify the computation. The performance of the proposed approach is demonstrated via simulations and real examples.

2 - Probabilistic Hashing Methods for Fitting Massive Logistic Regressions and SVM with Billions of Variables

Ping Li, Assistant Professor, Department of Statistical Science, Cornell University, 1192 Comstock Hall, Ithaca, NY, 14853-3801, United States of America, pingli@cornell.edu

Modern statistics tasks often encounter extremely high-dimensional massive data. In the context of search, certain industry applications have used datasets in 2^64 (square of billion) dimensions. We introduce a probabilistic method called b-bit minwise hashing, which can be seamlessly integrated with statistical learning algorithms such as logistic regression or SVM to solve extremely large-scale prediction problems. Experimental results on 200GB data (in billion dimensions) will be presented.

■ MD06

06- West 103 B- CC

Simulation Optimization and its Applications

Sponsor: Simulation

Sponsored Session

Chair: Demet Batur, Assistant Professor, University of Nebraska-Lincoln, CBA 209, Lincoln, NE, 68588, United States of America, dbatur2@unlnotes.unl.edu

1 - Optimal Computing Budget Allocation for a Single Design by using Regression with Sequential Sampling

Douglas Morrice, Professor, The University of Texas at Austin, Red McCombs School of Business, 2110 Speedway Stop B6500, Austin, TX, 78712-1750, United States of America, Douglas.Morrice@mccombs.utexas.edu, Xiang Hu, Loo Hay Lee, Chun-Hung Chen, Ek Peng Chew

In this paper, we develop an efficient single design budget allocation procedure using regression for a transient mean performance measure that follows a certain underlying function form. A sequential sampling constraint is imposed. We formulate the problem as a c-optimal design. The procedure provides the optimal number of simulation replications and simulation run lengths given a certain computing budget. Numerical experimentation confirms the efficiency of the procedure.

2 - Detecting Structure from Noisy Function Evaluations
Susan Hunter, Cornell University, School of ORIE, 282 Rhodes Hall, Ithaca, NY, United States of America, hunter@cornell.edu, Shane Henderson

We explore methods for detecting structure in functions that can only be observed as output from a stochastic simulation. Since simulation optimization algorithms often exploit some known structure of the underlying function, such as convexity, our methods may be considered a preprocessor that informs the selection of an appropriate simulation optimization algorithm.

3 - Reliability Analysis of Complex Systems based on the Stochastic Order
Demet Batur, University of Nebraska-Lincoln, CBA 209, Lincoln, NE, 68588, United States of America, dbatur@unl.edu, Fred Choobineh

Survival functions provide an indication about the likelihood of survival beyond a specific time. The reliability of system designs, such as designs for telecommunication and electrical power systems, are compared based on their survival functions. The survival functions are often tractable only via simulation. Here a statistical sequential selection procedure is presented to compare the survival functions of simulated stochastic systems based on the stochastic order dominance.

■ MD07

07- West 104 A- CC

Temporal Data Mining for Business Applications

Sponsor: Data Mining

Sponsored Session

Chair: W. Nick Street, The University of Iowa, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, nick-street@uiowa.edu

1 - Stock Chatter: Using Stock Sentiment to Predict Price Direction
Michael Rechenthin, The University of Iowa, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States of America, michael-rechenthin@uiowa.edu, W. Nick Street, Padmini Srinivasan

This paper examines a popular stock message board and finds that only 17.3 percent of posts include a user-provided sentiment of "strong buy", "buy", "hold", "sell", or "strong sell", but many of the remaining include sentiment only within the context of the post. Supervised learning methods were used to infer the sentiment from these posts' text and this predicted sentiment is found to be more predictive of the underlying stock's price directional change than the user-provided sentiment.

2 - Consistency in Vehicle Routing using Clustering
Fahrettin Cakir, The University of Iowa, Tippie Business College, Iowa City, IA, 52242, United States of America, fahrettin-cakir@uiowa.edu

Consistent service in vehicle routing is a valuable aspect for parcel delivery firms. This is due to driver familiarity and learning which enables drivers to serve neighborhoods quicker. We formulate a two stage vehicle routing decision problem in which the first stage puts emphasis on assigning customers to those drivers that have served the most via an auxiliary expression in the objective function in order to build consistent routing solutions.

3 - Regulating Greed over Time for Yahoo! Front Page News Article Recommendations
Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Virot Chiraphadhanakul, Ed Su

I will describe our second prize entry in the ICML Exploration and Exploitation 3 Challenge, which is a recommender system for Yahoo! News Article recommendations, involving multi-armed bandits and time series techniques.

4 - Click Logs Analysis for e-Commerce
Si-Chi Chin, The University of Iowa, 3087 LIB, W. Nick Street, Iowa City, IA, 52242, United States of America, si-chi-chin@uiowa.edu,

Click logs from e-Commerce sites provide a rich opportunity to acquire implicit feedback from users. Patterns derived from the time between a posted query and a click provide information on the ranking quality, reflecting the perceived relevance of a retrieved URL. This presentation applies the Kaplan-Meier estimator to study click patterns. The observed results demonstrate the potential of using click curves to predict the quality of the top-ranked results.

■ MD08

08- West 104 B- CC

Joint Session SPPSN/MIF: Managing Operations in Non-profit Food Distribution

Sponsor: Public Programs, Service and Needs & Minority Issues

Sponsored Session

Chair: Lauren Davis, North Carolina A&T State University, 1601 E. Market St., Greensboro, CA, United States of America, lbdavis@ncat.edu

1 - Modeling for Equitable Food Distribution in North Carolina under Capacity Constraints
Irem Sengul, North Carolina State University, 2101 Hillsborough St., Raleigh, NC, United States of America, isengul@ncsu.edu, Julie S. Ivy, Reha Uzsoy

We model the trade-off between equity and effectiveness with respect to the distribution of food donations in a specific region under capacity constraints. We work with the Food Bank of Central & Eastern North Carolina which serves as a hub and branch for distributing food to four branches in a 34-county service area. This presentation focuses on deterministic, capacity-constrained network flow models for this problem and the effect of distribution capacities on the optimal policy.

2 - An Approach to Approximating in-kind Donations Received by Food Banks through Supermarket Collection
Luther Brock, Doctoral Candidate, North Carolina A&T State University, 1601 East Market Street, Greensboro, NC, 27411, United States of America, lgbrockiii@hotmail.com, Lauren Davis

This research addresses the challenge of approximating the commodity-specific amount of in-kind food items received through an isolated food bank collection at supporting supermarkets. An artificial neural network (ANN) is developed based on past collection records maintained for a food bank in the southeastern United States. The accuracy of this ANN is compared to linear regression. The impact of improved forecast accuracy on transportation costs is demonstrated.

3 - Food Banks Can Improve their Operations with OR Tools
Canan Corlu, Assistant Professor, Bilkent University, Industrial Engineering Dept, Ankara, Turkey, canan.corlu@bilkent.edu.tr, Willem-Jan van Hoeve, Sridhar Tayur

In this study we work with Pittsburgh Community Food Bank (GPCFB) to improve their operations. We particularly focus on GPCFB's VRP, which has not been studied before, and evaluate three different approaches to solve this problem: MIP-based column generation, exact CP-based model and heuristic CP-based model. Our computational results indicate that the heuristic CP-based model can yield substantial savings even when a small number of changes (locations) are considered.

■ MD09

09- West 105 A- CC

Preference Learning I

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Roman Slowinski, Professor, Poznan University of Technology, 60-965 Poznan, Poznan, Poland, roman.slowinski@cs.put.poznan.pl

1 - Multiple Criteria Hierarchy Process in Robust Ordinal Regression: a New Way of Preference Learning
Salvatore Greco, Professor, University of Catania, Corso Italia 55, Catania, 95129, Italy, salgreco@unict.it, Salvatore Corrente, Roman Slowinski

To learn about preferences of a Decision Maker (DM) in multiple criteria decision problems involving hierarchical criteria, we propose a combination of Robust Ordinal Regression (ROR) and a method called Multiple Criteria Hierarchy Process. It permits learning of preference relations with respect to a subset of criteria at any level of the hierarchy. ROR takes into account all sets of parameters of an assumed preference model, which are compatible with preference information elicited by a DM.

2 - Preference Learning using Dominance-based Rough Set Approach

Roman Slowinski, Professor, Poznan University of Technology, 60-965 Poznan, Poznan, Poland, roman.slowinski@cs.put.poznan.pl, Salvatore Greco, Benedetto Matarazzo

Dominance-based Rough Set Approach permits inductive learning of a preference model from ordinal data consisting of exemplary decisions (classifications or pairwise comparisons of objects). The model is a set of easily understandable "if, then..." decision rules. It can be used to either justify past decisions, or predict future decisions, or develop a strategy of intervention. The rule model can represent more complex interactions among attributes than any utility function or binary relation.

3 - Indirect Elicitation of MCDA Sorting Models using Valued Assignment Examples

Olivier Cailloux, École Centrale Paris, Grande Voie des Vignes, Châtenay-Malabry, 92295, France, olivier.cailloux@ecp.fr, Brice Mayag, Vincent Mousseau, Luis Dias

We propose an elicitation method for learning MCDA sorting functions. Such a function assigns each alternative from a set of alternatives, evaluated on multiple criteria, to a category in a set of preference ordered categories. Our input is a set of assignment examples where each example contains several possible destination categories for an alternative, each associated with a credibility. We deduce several sorting functions whose precision depend on the chosen credibility level.

■ MD10

10- West 105 B- CC

Modeling Uncertainty in Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Vishal Gupta, Massachusetts Institute of Technology, 77 Massachusetts Ave, E40-135, Operations Research Center, Cambridge, MA, 02139, United States of America, vgupta1@mit.edu

1 - Optimization with Spectral Risk Measures

Garud Iyengar, Professor, Columbia University, New York, NY, United States of America, garud@ieor.columbia.edu, Carlos Abad

In this talk we will describe a fast-first order algorithm for optimization with several spectral risk measures.

2 - Appointment Scheduling with Limited Distributional Information

Jiawei Zhang, Stern School of Business, New York University, New York, NY, United States of America, jzhang@stern.nyu.edu, Ho-Yin Mak, Ying Rong

In this paper, we develop distribution-free models that solve the appointment scheduling and sequencing problems by assuming only moments information. In the special case where the first two marginal moments are given, the problem can be reformulated as a second-order cone program. Based on the structural properties of the two-moment model, we prove that, under a mild condition, it is optimal to sequence jobs in increasing order of duration variance.

3 - Constructing Uncertainty Sets from Data

Vishal Gupta, Massachusetts Institute of Technology, 77 Massachusetts Ave., E40-135, Operations Research Center, Cambridge, MA, 02139, United States of America, vgupta1@mit.edu

Modeling uncertainty via uncertainty sets and using robust optimization has become increasingly popular in recent years. In many applications, however, it is not clear how to construct an appropriate set. In this work we consider a nonparametric, data-driven approach to constructing uncertainty sets directly from historical samples of the uncertainty. Robust optimization problems using these sets remain tractable and enjoy strong probabilistic guarantees.

■ MD11

11- West 105 C- CC

Stochastic Programming Applications in Energy and Nonprofit

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Armagan Bayram, University of Massachusetts, Isenberg School of Management, Amherst, MA, United States of America, abayram@som.umass.edu

1 - Estimating the Operating Cost at Pumped-Storage Plants with Stochastic Optimization

Goran Vojvodic, PhD Student, George Washington University, 2201 G St. NW, Funger Hall 415, Washington, DC, 20037, United States of America, goranv@gwu.edu

A precise estimation of the operating cost for pumped-storage power plants is needed. A novel approach is presented based on a structural parallel between two-settlement energy markets and the two-stage stochastic optimization modeling paradigm in order to estimate the operating cost at a plant. The results differ from the deterministic approach and we believe they are more accurate because they were obtained using an approach that is structurally similar to the operation of energy markets.

2 - Stochastic Programming Based Resource Allocation Models for Nonprofit Foreclosed Housing Acquisition

Armagan Bayram, University of Massachusetts, Isenberg School of Management, Amherst, MA, United States of America, abayram@som.umass.edu, Senay Solak

We consider strategic resource allocation decisions for nonprofit community organizations that acquire and redevelop foreclosed properties as part of the societal response to foreclosures. We develop different multistage stochastic integer programming models for the problem, and discuss the efficiency of exact and heuristic solution approaches for these models.

■ MD12

12- West 106 A- CC

MIP Techniques for Solving Stochastic Programs

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48103, United States of America, siqian@umich.edu

1 - Integrated Staffing and Scheduling for Service Systems via Stochastic Integer Programming

James Luedtke, University of Wisconsin-Madison, 1513 University Ave., Madison, WI, 53706, United States of America, jrluedt1@wisc.edu, Merve Bodur

We consider the joint problem of staffing (determining how many servers of each type should be available in each time period) and scheduling (assigning servers to feasible schedules) in a service system having multiple server types and multiple customer classes. We introduce a stochastic integer programming formulation and study solution methods for this problem class.

2 - Valid Inequalities and Formulations for a Dynamic Optimization Problem under a Chance Constraint

Minjiao Zhang, Graduate Research Associate, The Ohio State University, Integrated Systems Engineering, 1971 Neil Ave., Columbus, OH, 43210, United States of America, zhang.769@osu.edu, Simge Kucukyavuz

We consider a dynamic decision-making problem under uncertainty with a service level constraint. We formulate this problem as a joint chance-constrained program, and propose a branch-and-cut algorithm utilizing its cardinality-constrained continuous mixing substructure. We also compare the joint chance-constrained model with a risk-averse model and a robust optimization model on a dynamic probabilistic lot-sizing problem.

3 - Risk Optimization in Probabilistic Programs with Single or Multiple Chance Constraints

Siqian Shen, Assistant Professor, University of Michigan, 2793 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48103, United States of America, siqian@umich.edu

This paper considers discretely distributed CCP, and trades off risk and cost by treating risk tolerances as decision variables. We first consider a problem with a single chance constraint, show that only finite risk thresholds affect optimum, and interpret the risk tolerance as SOS1 binary variables. We then optimize risk variables in multiple joint chance constraints. Our computations demonstrate that an enumeration takes longer CPU time than the MIP reformulation with SOS1 constraints.

■ MD13

13- West 106 B- CC

Recent Developments in Linear and Conic Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Murat Mut, PhD Student, Lehigh University, 200 W. Packer Ave, Bethlehem, 18015, United States of America, mhm309@Lehigh.EDU

1 - The Simplex Method and the Diameter of a 0-1 Polytope

Tomonari Kitahara, Tokyo Institute of Technology, W9-62, 2-12-1, Ookayama, Meguro-Ward, Tokyo, Japan, kitahara.t.ab@m.titech.ac.jp, Shinji Mizuno

We will derive two main results related to the primal simplex method for an LP on a 0-1 polytope. First we show a well-known result that the diameter of any 0-1 polytope is bounded by its dimension by a simple argument using the simplex method. Next we show that the upper bound obtained by the authors for the number of distinct solutions generated by the simplex method is tight by constructing an LP instance on a 0-1 polytope.

2 - On the Total Curvature of the Central Path

Murat Mut, PhD Student, Lehigh University, 200 W. Packer Ave., Bethlehem, 18015, United States of America, mhm309@Lehigh.EDU, Tamás Terlaky

We highlight the relevance of two different curvature measures for the complexity of interior-point methods in Linear Optimization. Motivated by the d-step conjecture for the total geometric curvature of the central path by Deza, Terlaky and Zinchenko (2008), we prove a similar result for the local curvature measure first introduced by Sonnevend et al. in 1990.

3 - Improved Simplex Algorithm for Nonstationary Markov Decision Processes and its Applications

Ilbin Lee, PhD Student, The University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ilbinlee@umich.edu, Marina Epelman, Edwin Romeijn, Robert Smith

Nonstationary Markov decision processes (MDPs) are infinite-horizon MDPs with time-varying problem data. They can be modeled as countably infinite linear programs (CILP's) but there is no general solution method for CILP's. Recently, a simplex-type algorithm for nonstationary MDPs was suggested. We improved this algorithm while still guaranteeing its convergence to an optimal solution, applied it to a production planning problem, and compared it to a planning horizon approach.

■ MD14

14- West 106 C- CC

Adversaries and Tradeoffs

Cluster: Scheduling and Project Management

Invited Session

Chair: Nicholas Hall, Professor, Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, hall.33@osu.edu

1 - Approximate Characteristic Functions for Intractable Cooperative Games in Operations Planning

Zhixin Liu, Assistant Professor, University of Michigan-Dearborn, zhixin@umd.umich.edu, Nicholas Hall

We design approximate characteristic functions for intractable operations planning games. An algorithm is proposed to specify solution procedure, solution space of coalitions' optimization problems, dependence of coalition value on outside decisions, and effective coalition structure. Applications include the knapsack problem, facility location, capacity allocation, the k-median problem, and flowshop sequencing.

2 - Dynamic Pricing with Minmax Regret

Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu, Nicholas Hall

We consider a two-period dynamic pricing problem where the decision maker has little demand information available and only knows lower and upper bounds of the demand functions. The objective is to minimize maximum regret. We propose two modeling approaches and solve the underlying problem efficiently in each case.

3 - Online Scheduling for Energy Minimization with a Constrained Adversary

Tulia Herrera, Columbia University, 500 West 120th Street, Rm. 313, New York, NY, 10027, United States of America, tjh2128@columbia.edu, Cliff Stein

We consider the problem of online scheduling to meet deadlines while minimizing energy in a two power state consumption system with a transition penalty. In general, no online algorithm can minimize energy and meet all deadlines. We propose using a constrained adversary and develop an algorithm that meets all deadlines and has small energy consumption. We bound the competitive ratio of the energy consumption and the total number of idle periods.

4 - Scheduling Two Chains on m Machines

Alessandro Agnetis, Professor, Universita di Siena, Dipartimento Ingegneria Informazione, via Roma 56, Siena, 53034, Italy, agnetis@dii.unisi.it, Hans Kellerer, Gaia Nicosia, Andrea Pacifici

A set of n tasks and m processing machines are given. Each task must be performed by one given machine, which can process only one task at a time. Precedence constraints exist among the tasks. We want to minimize a regular objective function of all task completion times. We address the case in which precedences take the form of two chains. We give complexity results for various special cases, including the weighted sum of task completion times and tardiness-related objectives.

■ MD15

15- West 202- CC

Software Demonstration

1 - Responsive Learning Technologies, Inc.- Online Games to Teach Operations and Supply Chain Management

Sam Wood, Responsive Learning Technologies, 4546 El Camino Real, #243, Los Altos CA 95014, United States of America, wood@responsive.net

Learn about online competitive exercises that are used in operations management courses and supply chain management courses to teach topics like capacity management, lead time management, inventory control, supply chain design and logistics. These games are typically used as graded assignments.

2 . Clear and Simple High Performance Technical Computing with Julia

Michael Bean, President, Forio Online Simulations, 1159 Bryant Street, San Francisco CA 94107, United States of America, mbean@forio.com

Julia is a new, high-performance dynamic programming language for technical computing that provides a sophisticated compiler, distributed parallel execution, numerical accuracy, and an extensive mathematical function library. Forio will demo its IDE for Julia that allows users to read, write, edit, and execute their Julia code and includes syntax-highlighting and code-completion.

■ MD16

16- West 207- CC

Teaching Dynamic Programming and Duality Insights using Games, Interdiction, and Robust Optimization

Cluster: Tutorials

Invited Session

Chair: J. Cole Smith, Professor, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, cole@ise.ufl.edu

1 - Teaching Dynamic Programming and Duality Insights using Games, Interdiction, and Robust Optimization

J. Cole Smith, Professor, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, cole@ise.ufl.edu

This tutorial discusses two aspects that often prove formidable to students: Dynamic programming (DP) and duality. We first discuss games that help teach DP concepts to undergraduate students in an entertaining and accessible manner. This background permits an application-oriented discussion of duality, which can in turn be used to teach emerging topics in interdiction and robust optimization. As a result, students may better understand the scope and limitations of modern optimization topics.

■ MD17

17- West 208 B- CC

Business Analytics Curriculum in Higher Education

Sponsor: INFORM-ED

Sponsored Session

Chair: Curt Hinrichs, JMP Academic Programs, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Curt.Hinrichs@jmp.com

1 - Positioning Analytics in Business Intelligence (BI) Curricula

Susan Palocsay, Professor, James Madison University, Computer Info Sys & Business Analytics, MSC 0202, Harrisonburg, VA, 22807, United States of America, palocssw@jmu.edu, Michel Mitri

The growth of BI technology has garnered a great deal of attention, and information systems (IS) curriculum guidelines recognize BI as a specific knowledge area within data/information management. Combined with the surging interest in business analytics, this presents an opportunity for introducing extended coverage of statistical analysis and OR/MS modeling skills into undergraduate IS programs. We will discuss alternative designs for BI curricula that incorporate varying levels of analytics.

2 - What Our MBA Students Tell Us About Analytics

Vijay Mehrotra, University of San Francisco, School of Management, 2130 Fulton Street, San Francisco, CA, United States of America, vmehrotra@usfca.edu, Thomas Grossman, Mouwafac Sidaoui

We have been teaching a core MBA course in Spreadsheet Modeling and Business Analytics for the past several years. This class has been enthusiastically received by both full-time and part-time students, and has led to the creation of student-driven electives. In this talk, we will describe the innovative aspects of our core class and discuss what we have learned from our students in recent years.

3 - UConn's Masters Program in Business Analytics and Project Management

Sudip Bhattacharjee, Associate Professor, University of Connecticut, Storrs, CT, United States of America, sbhattacharjee@business.uconn.edu, Ram Gopal, James Marsden

The Operations and Information Management department of UConn's School of Business launched a MS in Business Analytics and Project Management in Fall 2011. We detail our motivation and vision for the program, the structure and interdependencies of analytics courses we deliver, and the skills and value that students gain. We highlight the importance of analytics and our faculty expertise working in several corporate analytics research projects using SAS tools and various methodologies.

4 - Experiences with Developing an Advanced Business Analytics Course

Jerry Oglesby, Senior Director, SAS, SAS Campus Drive, Cary, NC, 27513, United States of America, jerry.oglesby@sas.com

A survey course on Business analytics was developed by SAS for masters level instruction. We describe the market forces and rationale for key topics included in the course and the challenges in balancing depth with breadth of coverage. We will discuss feedback and evolution of the course over the past 2 years and insights on where the survey course is heading.

■ MD18

18- West 208 A- CC

Optimization with Surrogates

Sponsor: Optimization/ICS- Derivative-free and Surrogate Optimization

Sponsored Session

Chair: Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu

1 - Derivative-free Optimization Enhanced-surrogate Model Development for Optimization

Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu, Alison Cozad, David Miller

We propose a model generation method that uses derivative-based and derivative-free optimization alongside machine learning and statistical techniques to learn algebraic models of detailed simulations. Once a candidate set of models is defined, they are tested, exploited, and improved through the use of derivative-free solvers to adaptively sample new points. We provide extensive computational experience with ALAMO, a code that we have developed to implement this strategy.

2 - Large-scale Expensive Black-box Function Optimization using an Adaptive Radial Basis Function Method

Kashif Rashid, Principal Research Scientist, Schlumberger-Doll Research, 1 Hampshire Street, Cambridge, MA, 02139, United States of America, krashid@slb.com, Benoit Couet, William Bailey

Optimization of a computationally expensive black-box reservoir simulation model of many variables is demonstrated using an adaptive radial basis function method. The iterative proxy-based scheme is used to tune the control variables, distributed for finer control over a varying number of intervals covering the total simulation period, to maximize asset NPV. The method shows that large-scale simulation-based function optimization of several hundred variables is practical and effective.

3 - Using Surrogates to Calculate Sensitivity Analysis While Optimizing

Genetha Gray, Sandia National Labs, P.O. Box 969, MS 9159, Livermore, CA, 94551-0969, United States of America, gagray@sandia.gov, John D. Siirola, Ethan Chan

In this talk, we will describe how hybridization can be used incorporate sensitivity analysis into optimization procedures. Specifically, by dynamically incorporating Bayesian sensitivity techniques into the minimization process, we will show how the usefulness of computational models can be drastically improved. We will review the basic hybridization algorithm and resulting software. We will also give some ideas for useful hybrids and show some results for a real world problem.

4 - Locally-Biased Efficient Global Optimization for Black-Box Optimization using Kriging Surrogates

Rommel Regis, Assistant Professor, Saint Joseph's University, Department of Mathematics, 5600 City Avenue, Philadelphia, PA, 19131, United States of America, rregis@sju.edu

The Efficient Global Optimization (EGO) algorithm by Jones et al. (1998) is a popular surrogate-based method that works well on many problems. However, its performance on high-dimensional problems and low-dimensional problems with deep and narrow basins tends to be relatively poor. This talk presents locally-biased forms of EGO that address this issue and that yield dramatic improvements over EGO on a 14-D watershed model calibration problem and on several test problems with up to 30 dimensions.

5 - Asynchronous Parallelization of Surrogate Response Surface Methods for Global Optimization

Christine Shoemaker, cas12@cornell.edu, Tipaluck Krityakierne, Taimoor Akhtar

Response surfaces reduce effort for computationally expensive Black-Box Simulation Optimization for multimodal continuous variable problems. This effort can be further reduced through algorithm changes to facilitate asynchronous parallelism. Methods will be discussed. The major issue is selecting the next points in decision space at which simulations will be done when multiple processors are available to accept new jobs at different times because of heterogeneity in processor speeds.

■ MD19

19- West 211 A- CC

Topics in Appointment Scheduling

Contributed Session

Chair: Carter Browning, University of Oklahoma, 1315 Northcrest Dr., Ada, OK, 74820, United States of America, cbrowning@ou.edu

1 - Designing Appointment Schedules in Health Care: Dealing with Walk-in Patients

Ingrid Vliegen, Assistant Professor, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, i.m.h.vliegen@utwente.nl, Joost Veldwijk, Aleida Braaksma, Nelly Litvak

Traditionally diagnostic facilities schedule appointments for all patients. Allowing patients to walk in without an appointment, however, speeds up the process and reduces access times. We develop an algorithm that generates appointments schedules in which both patients with an appointment and walk-in patients can be served. Our study shows promising results with respect to the fraction of walk-in patients served, the access time of patients with an appointment and the computation time needed.

2 - Forecasting Binary Outcomes with Order-constrained Coefficients

Shannon Harris, Katz Graduate School of Business, 241 Mervis Hall, Pittsburgh, PA, 15213, United States of America, sharris@katz.pitt.edu, Jerry May

We consider the problem of forecasting the probabilities for binary outcomes using historical data with the impact of historical behavior decreasing over time. The work is motivated by trying to model patient no-show probability in an outpatient clinic. Future no-show behavior is a function of past behavior, but patients change their habits over time. We illustrate our approach using data from VA outpatient clinics.

3 - Reducing Patient Wait Times in Emergency Departments
Shanshan Qiu, Wayne State University, Industrial & Systems Engineering Department, Detroit, MI, 48202, United States of America, shanshan@wayne.edu, Ratna Babu Chinnam, Alper Murat, Evrim Dalkiran, Qingyu William Yang

Emergency Departments (EDs) in hospitals are experiencing a trend of severe crowding and prolonged patient waiting times. Some of these delays can be attributed to delays in identifying and readying beds for patients to be transferred to admit wards. We propose effective models to predict patient admission likelihood early on during ED triage so that necessary preparation steps can be taken early to reduce transfer delays. We also present results from Detroit VA Medical Center.

4 - Physician Dual Practice, Public Waiting Time and Patient Welfare
Qu (Alex) Qian, Assistant Professor, Shanghai University of Finance and Economics, 777 Guoding Road, School of International Business Adm, Shanghai, 200433, China, qian.qu@mail.shufe.edu.cn, Anming Zhang, Hong Chen

We use a stylized model to investigate the waiting time difference between dual-practice physicians and public-only physicians. We study the impact of physician dual practice on patient's waiting time and welfare. Although patients with lowest time costs have to endure a longer waiting time if physician dual practice is allowed, some of these patients may benefit as they could self-select dual-practice physicians and enjoy a service of higher quality.

5 - The Analysis of a Hospital Clinic Based on Support Vector Regression
Carter Browning, University of Oklahoma, 1315 Northcrest Dr., Ada, OK, 74820, United States of America, cbrowning@ou.edu

The shift from inpatient to outpatient services is becoming increasingly popular. With this shift, arrival and service times have become a greater problem for administrators. Evaluating queue performances requires the knowledge of these arrival and service density functions beforehand. Using support vector regression we can solve for the density function and evaluate outpatient services.

■ MD20

20- West 211 B- CC

The Business of Health Care

Contributed Session

Chair: Cigdem Gurgur, Purdue University, 2101 East Coliseum Blvd., Fort Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu

1 - Panel Related Factors of Healthcare Bundled Payments
Wei Liu, Graduate Research Assistant, Purdue University, Gerald D. and Edna E. Mann Hall, Suite22, 203 Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, liu317@purdue.edu, Ping Huang

The Bundled Payments for Care Improvement Initiative is considered to be an effective way to improve care coordination among multiple healthcare providers. In this research, several data analyses have been conducted to explore the panel related factors (e.g., patient's comorbidities, available panel resources, interaction between multiple facilities and providers etc) that may cause the variations of utilizations in a defined episode of care.

2 - Value-based Competition in Health Care Delivery
Tannaz Mahootchi, PhD Candidate, Wilfrid Laurier University, 75 University Ave. W, Waterloo, ON, N2L3C5, Canada, tmahootchi@wlu.ca, Ignacio Castillo

Reforming health care delivery to value-based competition requires building Integrated Practice Units (IPU) on medical conditions over full cycle of care. Changing the nature of competition based on results will require different performance measures and payment systems. Challenges include pricing for care cycles and deploying mechanisms to facilitate collaboration among specialties in an IPU. This study explores the challenges and provides some insights on effective mechanisms.

3 - Competing on Quality: Evidence from Award Winning Hospitals in California
Wei Wu, University of Tennessee Knoxville, 916 Volunteer Blvd., Knoxville, TN, 37996, United States of America, wwu3@utk.edu, Randy Bradley, Bogdan Bichescu

Healthcare is a highly competitive environment in which hospitals compete against one another to both provide services to patients and attract indispensable resources (i.e., nurses and physicians) to deliver their services. We investigate the marketing, operational, and financial benefits associated with winning quality awards, by performing a matching study that compares quality award-winning hospitals to comparable hospitals without quality awards during the period of our study.

4 - Tradeoffs in Bundling Decisions for Healthcare Products
Cigdem Gurgur, Purdue University, 2101 East Coliseum Blvd., Fort Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu

In this study we consider supplier selection and quantity allocation decisions for a health care organization that may purchase a number of unbundled products and refurbished products under stochastic demand. We use data from a large healthcare provider in Indiana to test the implications of our study.

■ MD21

21- West 212 A- CC

Network Games and Interdiction

Sponsor: Optimization/Networks

Sponsored Session

Chair: Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu

1 - Geometric Interdiction of Multi-State Networks with Stochastic Interdiction Effect
Hugh Medal, Industrial and Systems Engineering, Mississippi State University, Mississippi State, MS, 39762, United States of America, hmedal@ise.msstate.edu

We study a network interdiction problem in which the interdictor, seeking to maximally disrupt the flow of an adversary, stages attacks at points within a geographic area containing the network. These attacks expose surrounding network elements to hazards with intensity proportional to hazard magnitude and distance to the center of the hazard. The post-disruption element capacity is a random function of the hazard intensity. We present a stochastic programming strategy to solve the problem.

2 - Deception Tactics for Network Interdiction: A Multi-Objective Approach
Javier Salmerón, Associate Professor, Naval Postgraduate School, jsalmero@nps.edu

This work develops defender-attacker network interdiction models with deception, i.e., where the defender is allowed to use interdiction assets and decoys that are not realized by the attacker. We develop a mixed-integer programming formulation as a generalized network, and its Benders decomposition. We also show a multi-objective extension to accommodate several attacker behaviors. Our computational tests show the difficulty in solving these problems optimally.

3 - Locating Direction Finders to Maximize Detection Effectiveness
Wilbert Wilhelm, Professor, Texas A&M University, Department of Industrial and Sytems Engineering, TAMU3131, College Station, TX, 77843-3131, United States of America, wilhelm@tamu.edu, Suhwan Kim

A set of electronic direction finders is used by the military to locate the source of radio frequencies emitted on the battlefield by enemy forces. In modern warfare, it is crucial to detect the enemy as early as possible to gain advantage. This paper describes a new formulation to prescribe the deployment (i.e., location) of direction finders that maximizes the effectiveness with which emitters can be detected using a resource-constrained shortest path model.

4 - Convex Hull Representation of the Bipartite Max-Reliability Path Interdiction Problem
Kelly Sullivan, University of Arkansas, 4207 Bell Engineering Center, 1 University of Arkansas, Fayetteville, AR, 72701, United States of America, kmsullivan@ufl.edu, David Morton, J. Cole Smith

We consider the problem of installing sensors on arcs in a network in order to minimize a smuggler's maximum probability of traversing from a known origin to a known destination without being detected. We develop an class of inequalities that produces the convex hull for the case when sensor installations are restricted to arcs in a predefined cut-set. These inequalities may be useful in solving a generalized version of this problem in which the smuggler's origin and destination are unknown.

■ MD22

22- West 212 B- CC

What's New in Coopr

Sponsor: Computing Society

Sponsored Session

Chair: David L. Woodruff, University of California-Davis, Graduate School of Management, Davis, CA, 95616, United States of America, dlwoodruff@ucdavis.edu

1 - What's New in Coopr I

John D. Siirola, Sandia National Laboratories, P.O. Box 5800 MS 1326, Albuquerque, NM, 87185, United States of America, jdsiiro@sandia.gov, David L. Woodruff, William E. Hart, Jean-Paul Watson

We describe new features in the open-source software for modeling and optimization called Coopr. The Python-based algebraic modeling language Pyomo is being extended in many ways including the provision of user-defined workflows, more efficiency, and model blocks for specifying aggregations of model components. The PySP stochastic programming package has expanded support for chance constraints, automatic computation of the expected value of a stochastic solution, and numerous other extensions.

2 - What's New in Coopr III

Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87113, United States of America, jwatson@sandia.gov, David L. Woodruff, William E. Hart, John D. Siirola

We describe new features in the open-source software package for modeling and optimization called Coopr. The Python-based algebraic modeling language Pyomo is being extended in many ways including the provision of user-defined workflows, more efficiency, and model blocks for specifying aggregations of model components. The PySP stochastic programming package has expanded support for chance constraints and automatic computation of the expected value of a stochastic solution.

3 - What's New in Coopr IV

David L. Woodruff, University of California-Davis, Graduate School of Management, Davis, CA, 95616, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson, John D. Siirola, William E. Hart

We describe new features in the open-source software for modeling and optimization called Coopr. The Python-based algebraic modeling language Pyomo is being extended in many ways including the provision of user-defined workflows, more efficiency, and model blocks for specifying aggregations of model components. The PySP stochastic programming package has expanded support for chance constraints, automatic computation of the expected value of a stochastic solution, and numerous other extensions.

■ MD23

23- West 212 C- CC

Issues in the Semiconductor Industry

Contributed Session

Chair: Zhufeng Gao, The University of Texas, 2004 E. Dean Keeton, Street C2200, Austin, TX, 78712-1591, United States of America, gaozhufeng@utexas.edu

1 - Approximating the Yield in Wafer to Wafer Integration Problem

Trivikram Dokka, Katholieke Universitiet Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Trivikram.Dokka@econ.kuleuven.be, Frits Spieksma

We consider the yield maximization problem in wafer to wafer 3D integration. We formulate the wafer to wafer integration prob- lem as a multidimensional assignment problem. We settle its complexity status and study the problem from approximation point of view. We give simple algorithms for a special case and comment on the approximability of the general case.

2 - Real-time Decision Support for Assembly and Test Operations in Semiconductor Manufacturing

Zhufeng Gao, The University of Texas, 2004 E. Dean Keeton, Street C2200, Austin, TX, 78712-1591, United States of America, gaozhufeng@utexas.edu, Jonathan Bard

We will introduce an efficient procedure for prioritizing machine changeovers in a semiconductor assembly and test facility on a periodic basis. In daily planning, target machine-tooling combinations are derived based on work in process, due dates, and backlogs. As machines finish their current lots, they need to be reconfigured to match their target setups. The proposed algorithm is designed to achieve this objective and run in real time with high-quality solutions obtained in negligible time.

■ MD24

24- West 213 A- CC

Optimizing Patients Schedules for Improving Healthcare Delivery

Sponsor: Health Applications Society

Sponsored Session

Chair: Nadia Lahrichi, Professor, École Polytechnique de Montreal, C.P. 6079, Succ. Centre-ville, Montreal, QC, H3C3A7, Canada, Nadia.Lahrichi@polymtl.ca

1 - Towards Broad Appointment Scheduling Policies: Enriched Understanding from Simulation Optimization

Ken Klassen, Professor, Brock University, Dept. of Finance, Operations & IS, St Catharines, ON, L2S3A1, Canada, kklassen@brocku.ca, Reena Yoogalingam

The unique and highly variable characteristics of outpatient clinics make it challenging to develop broad policies for scheduling appointments. The presence of factors such as patient and doctor unpunctuality, interruptions and no-shows further complicates this process. This study uses a simulation-optimization framework based on empirical data to develop general insights into appointment system design.

2 - An Approximate Auction-based Coordination Mechanism for Dynamic Patient Scheduling under Uncertainty

Hadi Hosseini, University of Waterloo, 200 University Ave., West, Waterloo, ON, N2L3G1, Canada, h5hosseini@uwaterloo.ca, Jesse Hoey, Robin Cohen

Computing an optimal solution for the problem of stochastic healthcare scheduling is computationally intractable. We propose an approximate multiagent resource allocation technique to find possible alternatives that maximize a social welfare function. Each patient formulates its internal preferences, success model, and temporal dependencies between resources as a single MDP. An auction-based coordination mechanism is then applied to find a close-to-optimal allocation of the aggregated MDPs.

3 - Setting Surgical Schedules to Optimize Downstream Resource Utilization

Patrick Jonathan, Professor, University of Ottawa, 55 Laurier Avenue, Ottawa, ON, K2G 3A6, Canada, patrick@telfer.uottawa.ca, Davood Astaraky

Determining an appropriate surgical schedule is a tough decision process that requires the administrator to assess competing priority classes and surgical types, variable surgical times and lengths of stay post-surgery. We seek to develop a model that optimally allocates surgeries into pre-determined surgical blocks in order to maximize utilization of operating room time and post-op beds while meeting priority specific wait time targets using an approximate dynamic programming approach.

4 - Online Optimization of Radiotherapy Patient Scheduling

Antoine Legrain, PhD Candidate, École Polytechnique Montreal, Pavillon André-Aisenstadt, Bureau 3520, 2920, Chemin de la Tour, Montrèal, QC, H3T 1J4, Canada, antoine.legrain@polymtl.ca, Nadia Lahrichi

An efficient radiotherapy patient scheduling on the linear accelerators is crucial to ensure the delivery of the treatment respecting all delays. Different contradictory objectives and constraints have to be taken into account. We propose a hybrid algorithm using online and stochastic optimization. Online methods allow scheduling a patient whenever according to the preference of the user and stochastic tools authorize to infer the future in order to take into account prospective patients.

■ MD25

25- West 213 B- CC

Simulation Optimization in Healthcare

Sponsor: Health Applications Society

Sponsored Session

Chair: Daniel Underwood, North Carolina State University, 111 Lampe Drive, 373 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, daniel.underwood@ncsu.edu

1 - Scheduling Patient Transports for an Air Ambulance Service

Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14850, United States of America, sgh9@cornell.edu, Timothy Carnes, Russell Macdonald, Mahvareh Ahghari, David Shmoys

Ornge is a not-for-profit company that provides air-ambulance services to Ontario. A major part of their operations involves transporting patients between health facilities using a collection of fixed-wing aircraft stationed around the province. The requests are received a day in advance, and scheduled overnight. I will describe our work in using set partitioning to perform the scheduling, and its impact on Ornge's operations.

2 - Mitigating the Operational Effects Patient Isolation Requirements in Hospital Bed Assignments

Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, KGCOE-1593, Rochester, NY, 14623, United States of America, rpmeie@rit.edu

We present an optimization model that suggests how to accommodate admitted and incoming patients in a hospital unit in order to satisfy all isolation requirements, while simultaneously ensuring the unit is used by the most critical patients, and minimizing the number of internal movements (i.e., patient shuffles). The model is then integrated into a Monte Carlo simulation experiment to determine how many single- and double-patient rooms are necessary to minimize the number of internal movements.

3 - Optimizing Pandemic Control Strategies using Simulation Meta-modeling

Michael Beeler, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, mfbeeler@gmail.com, Michael Carter, Dionne Aleman

Pandemic simulations can be so high-dimensional that it is difficult for conventional designed experiments to explore the full space of possible disease parameters, population characteristics, and simulated pandemic responses. Stochastic kriging, an alternative simulation meta-modeling technique, is used to search the simulation design space for good pandemic control strategies and construct a response surface covering a range of possible future scenarios.

4 - The Impact of Flexibility and Capacity Allocation on the Performance of Primary Care Practices

Hari Balasubramanian, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu, Xiaoling Gao, Ana Muriel

We adapt ideas of manufacturing process flexibility to the management of continuity and timely access in primary care practices. Timely access focuses on the ability of a patient to get access to a physician. Continuity refers to building a strong relationship between patient and physician by maximizing patient visits. We develop a two-stage stochastic integer program to investigate optimal capacity allocation for prescheduled and same-day patients, and the value of different flexible policies.

■ MD26

26- North 221 A- CC

Retail Operations II

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Dorothee Honhon, Technische Universiteit Eindhoven, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, d.b.l.p.honhon@tue.nl

Co-Chair: Xiajun Amy Pan, University of Florida, United States of America, amypan@ufl.edu

1 - Integrated, Multi-Category, Pricing, Assortment and Inventory Decisions under Cross Selling

Bacel Maddah, Associate Professor, American University of Beirut, Bliss Street, Beirut, Lebanon, bm05@aub.edu.lb, Ahmed Ghoniem, Ameera Ibrahim

We formulate a nonlinear integer program that jointly optimizes retail decisions on assortment, pricing, and inventory for two complementary categories, primary (e.g. toys) and secondary (e.g. batteries). We model asymmetric cross-selling, where some customers who purchase from the primary category (e.g. a toy) also buy from the secondary category (e.g. a battery). We develop an exact linear reformulation, which is efficiently solved to optimality on CPLEX.

2 - Assortment Planning with Vertically and Horizontally Differentiated Products

Lei Xie, Assistant Prof., Shanghai Jiaotong University, 1954 Huashan road, shanghai, P.R.China, Shanghai, China, leixie@sjtu.edu.cn, Yulan Wang, Xiaofeng Shao

Companies always design product lines by segmenting their markets on quality and taste attributes. Existing operations management literature mainly focuses on either vertically or horizontally differentiated products. In our paper, we consider such a scenario where a monopoly firm designs the product line on both quality and taste attributes, and jointly optimize the assortment and pricing decisions. We also derive the structure of the optimal assortment policy.

3 - Assortment Planning and Customer Segmentation

Denis Saure, Assistant Professor, University of Pittsburgh, 1042 Benedum Hall, 3700 O'Hare Street, Pittsburgh, PA, United States of America, dsaure@pitt.edu

We study the problem of a retailer facing heterogeneous consumers with initially unknown preferences. The retailer might customize offerings based on available profile information. However, users with different profiles might behave identically, suggesting that no all information is relevant. Thus, the retailer might benefit from pooling customers with similar behavior. We propose policies that dynamically adjust customer segmentation to maximize cumulative revenue.

4 - Bundling Strategies for Vertically Differentiated Products

Xiajun Amy Pan, University of Florida, United States of America, amypan@ufl.edu, Dorothee Honhon

In this paper, we study how to choose the optimal bundling strategy for a retailer offering vertically differentiated products. We characterize conditions under which different bundling strategies are optimal respectively and provide efficient methods to identify optimal prices for offered products in order to maximize the retailer's profit.

■ MD27

27- North 221 B- CC

Strategies in Retail

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Achal Bassamboo, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu

1 - Impact of Delay Announcement: An Empirical Study

Qiuping Yu, Student, Northwestern University, 2145 Sheridon, Evanston, IL, 60201, United States of America, yqp2009@gmail.com, Gad Allon, Achal Bassamboo

Many service systems announce anticipated delay to the customers. In this paper, we explore the impact of such announcement. We study the data from a medium size call center where the customers are provided announcement concerning their delay. The data provides information about how long the customer stayed in system before they decided to abandon or entered service, whichever occurred first.

2 - Online-offline Strategies in Retail
Santiago Gallino, The Wharton School, 3720 Walnut St., Philadelphia, 19104, United States of America, sgallino@wharton.upenn.edu, Antonio Moreno-Garcia

Using a dataset from a leading retailer, we study the effect on customer behavior of online-offline integration strategies, such as showing inventory information online and store pickup of online orders.

3 - Who Are My Competitors? Let the Customer Tell
Jun Li, lijun1@wharton.upenn.edu, Serguei Netessine

Identifying competitor set is critical yet challenging in hotel industry. Based on click-stream data from a major Online Travel Agent, we develop an approach to construct hotel competition network. Furthermore, according to hotelier competitive pricing behavior, we find that there is a mismatch between hoteliers' and customers' perspective of competitor sets.

4 - Service Competition and Product Quality in the U.S. Automobile Industry
Jose Guajardo, josegu@wharton.upenn.edu, Morris Cohen, Serguei Netessine

We formulate and estimate a structural econometric model to study the role of services in the U.S. automobile industry. We analyze the impact of service attributes on demand, and test whether the effects of service attributes and product quality are independent, complementary or substitutes. Our findings indicate that service attributes act as complements in the demand function, and conversely, that service attributes play the role of substitutes with respect to product quality.

■ MD28

28- North 221 C- CC

Choice Models in Operations and Revenue Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yuri Levin, Professor, Queen's School of Business, 143 Union St., Kingston, Canada, ylevin@business.queensu.ca

1 - A New Approach to Hotel Pricing
Dan Zhang, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, dan.zhang@colorado.edu, Lawrence Weatherford

We show that a non-linear non-separable approximation architecture proposed in the recent work of Zhang (2011) can be generalized to dynamic pricing for network revenue management. This generalization leads to tighter bounds and better heuristic policies than widely used DAVN type approaches. We provide a case study with data from a major US hotel.

2 - Intermediation in Salvage Markets with Strategic Consumers
Pnina Feldman, Haas School of Business, UC Berkeley, 545 Student Services Bldg #1900, Berkeley, CA, 94720, United States of America, feldman@haas.berkeley.edu, Kate Ashley

Motivated by the proliferation of third-party salvage firms such as Overstock.com, we consider the operational benefits that such firms can provide to sellers. The setting is a variation on the classic newsvendor: a seller can either sell surplus units directly to customers, or sell to an intermediary at a lower price. We find that if customers are strategic, the longer supply chain may perform better, even if the intermediary has no cost or marketing advantages.

3 - Equilibrium in Queues under Unknown Service Rates and Service Value
Senthil Veeraraghavan, Associate Professor, The Wharton School, 3730 Walnut Street Suite 550, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We study queue joining equilibrium when there is uncertainty on service rates and service value. We show that equilibrium may not be a simple threshold policy, and a "sputtering equilibrium" might exist. In the sputtering equilibrium, the joining behavior is non-monotone. Consumers balk from a queue at some queue length following a randomized decision, but will always join when the queue gets longer.

4 - Dynamic Pricing of Flight Passes
Yuri Levin, Professor, Queen's School of Business, 143 Union St., Kingston, Canada, ylevin@business.queensu.ca, Mikhail Nediak, Huseyin Topaloglu

Many airlines have recently introduced a "flight pass" which targets customers in a frequent traveler segment. This product permits its holder to obtain a seat on a specified number of flights at a fixed price. Dynamic pricing of passes is contingent upon pricing of individual flights and how forward-looking customers choose between passes and individual bookings. We present a stochastic dynamic programming formulation for this problem and analyze the properties of the pricing policy.

■ MD29

29- North 222 A- CC

Resource Allocation in Healthcare Systems

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Carri Chan, Columbia Business School, 3022 Broadway, Uris 410, New York, NY, United States of America, cwchan@columbia.edu

1 - Decomposing the Impact of Workload on Patient Outcomes
Michael Freeman, Judge Business School, University of Cambridge, Cambridge, United Kingdom, mef35@cam.ac.uk, Nicos Savva, Stefan Scholtes

Previous work has shown that in-patient outcomes deteriorate at high workloads. In this paper we use a detailed dataset from the Delivery Unit of a large UK hospital to investigate the operational factors that drive this this deterioration. We discuss findings and implications for hospitals.

2 - Optimizing the Flow of Short-Stay Patients in the Intensive Care Unit: A Simulation Model
Elisa Long, Assistant Professor, Yale School of Management, New Haven, CT, 06520, United States of America, elisa.long@yale.edu, Kusum Mathews

As demand for intensive care unit (ICU) beds increases, optimizing patient throughput is needed. Using 9-months of data for Yale-New Haven Hospital, we characterized "short-stay" patients (<24 hours), who account for 35% of ICU patients. Approximately 50% of short-stay patients were lower-acuity and could be treated in a step-down unit (SDU). We developed a simulation model with priority queuing to determine the optimal allocation of ICU and SDU beds.

3 - A Mixed Integer Programming Approach to Improve Operational Scheduling of Radiation Therapists
Vincent Chow, Operations Research Analyst, British Columbia Cancer Agency, 600 West 10th Ave., Vancouver, BC, V5Z4E6, Canada, vchow@bccancer.bc.ca, Pablo Santibanez, Travis Nordin, John French, Martin Puterman, Scott Tyldesley

Radiation therapists (RTs) are integral to cancer care, performing tasks such as imaging, treatment planning and delivery. We present a mixed integer programming model to create RT schedules with daily assignments. Results from implementation at a mid-size center in Western Canada show 30% to 40% improvement in a range of quality metrics. The model is packaged into a customized web-based scheduling platform and used by the RT manager on a regular basis.

4 - ICU Admission Control: An Empirical Study of Capacity Allocation and Patient Outcomes
Song-Hee Kim, Columbia University, 500 W 120th Street, New York, NY, United States of America, sk3116@columbia.edu, Marcelo Olivares, Carri Chan

We examine how congestion in the ICU can impact the care pathway of patients and, ultimately, patient outcomes. We develop a stylized model for ICU admission and use the insights gained to develop an empirical framework, in which instrumental variable approach is used to identify the effect of the endogenous admission decision. We estimate these models using a large data set from an integrated healthcare delivery system and discuss the results' substantial health and financial implications.

■ MD30

30- North 222 B- CC

Impact of Credit on Operations

Sponsor: Manufacturing & Service Oper Mgmt/IFORM

Sponsored Session

Chair: Sridhar Seshari, Professor, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States of America, Sridhar.seshadri@mccombs.utexas.edu

1 - The Effect of Trade Credit in Supply Chains

John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu, Song Alex Yang

Trade credit is the dominant source of short-term credit for most firms. In previous work, we described a model of firm interactions in which trade credit serves as a risk-sharing mechanism that improves chain efficiency. This talk discusses predictions from this model and empirical evidence.

2 - Operational Investment and Capital Structure under Asset Based Lending

Vishal Gaur, Professor, Cornell University, Johnson School, Ithaca, NY, 14853, United States of America, vg77@cornell.edu, Yasin Alan

We study the implications of asset based lending for operational investment, probability of bankruptcy, and capital structure for a newsvendor firm. Using a single-period game between a business owner and a bank, we show how asset based lending helps the bank mitigate adverse selection under information asymmetry. We derive the collateral value of inventory, which contrasts with simple rules of thumb used by banks in practice.

3 - An Analysis of Inventory Financing Cost and Performance

Sridhar Seshari, Professor, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States of America, Sridhar.seshadri@mccombs.utexas.edu, Qi Wu, Kumar Muthuraman

In this paper, we study the inventory performance of publicly listed firms between 1985 and 2010 and show how the effect of cost of capital should be accounted for in inventory decisions. We also examine how financing and inventory decisions jointly impact one another after controlling for various operational and financial factors.

4 - Working Capital Constraints and Inventory

Yale T. Herer, Technion-Israel Institute of Technology, Israel, yale@technion.ac.il, Enver Yücesan, Illana Bendavid

Curiously absent from the inventory operations literature are models that consider financial constraints imposed by working capital requirements (WCR). In practice, however, many firms are self-financing, i.e., their ability to replenish their own inventories is directly affected not only by their current inventory levels, but also by their receivables and payables. In this paper, we analyze the materials management practices of a self-financing firm whose replenishment decisions are constrained by cash flows. In particular, we investigate the interaction between the financial and operational parameters as well as the impact of WCR constraints on the long-run average cost.

■ MD31

31- North 222 C- CC

Service Quality, Staffing and Marketing for Congestion-prone Services

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Philipp Afeche, Rotman School of Management, University of Toronto, 105 St.George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca

1 - Design of an Aggregated Marketplace under Congestion Effects: Asymptotic Analysis and Equilibrium Characterization

Ying-Ju Chen, UC Berkeley, Berkeley, United States of America, chen@ieor.berkeley.edu, Gustavo Vulcano, Costis Maglaras

We study an aggregated marketplace where potential buyers arrive and submit requests-for-quotes (RFQs). We characterize the asymptotic performance of this system, and subsequently extract insights about the equilibrium behavior of the suppliers. We show that supplier competition results into a mixed-strategy equilibrium phenomenon and is significantly different from the centralized solution. We propose a compensation-while-idling mechanism that coordinates the system.

2 - Asymptotic Stability of AR(1)-Driven Workforce Scheduling Models

Yong-Pin Zhou, Associate Professor, University of Washington and University of Hong Kong, Box 353226, Seattle, WA, 98195-3226, United States of America, yongpin@u.washington.edu, Noah Gans, Haipeng Shen, Han Ye

We determine workforce schedules for call center arrivals that are doubly stochastic. Period-by-period arrival rates follow a hidden AR(1) process, and only arrival counts are observed. We formulate stochastic programs to minimize long-run average staffing costs, subject to a long-run average constraint on abandonment. We show that, in steady state, repeated, myopic solution of the single-period problem is stable, has low cost, and meets the abandonment constraint.

3 - Formulation Choice in Call Centers: Service-level Differentiation Revisited

Itai Gurvich, Northwestern University-Kellogg School of Management, Evanston, IL, United States of America, i-gurvich@kellogg.northwestern.edu, Seung Bum Soh

We study formulation choice for call-center staffing. We formalize an intuitive notion of Service-Level Differentiation and show how the staffing and prioritization rules depend on the choice of differentiation-degree. We prove the convexity of the staffing cost as a function of the differentiation degree. We also prove that monotone-index policies that are appealing and widely used in practice are, in fact, optimal under the appropriate formalization of service-level differentiation.

4 - Demand and Capacity Management for a Call Center: Optimal Priorities, Promotions and Staffing

Mojtaba Araghi, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, Canada, mojtaba.araghi08@rotman.utoronto.ca, Philipp Afeche, Opher Baron

We study the problem of maximizing the profit of an inbound call center that controls promotions, staffing and priorities to new vs. base customers. We develop a deterministic fluid model that links these controls to customer flows, the size of the customer base and key performance measures. We generate analytical prescriptions on the optimal decisions for the fluid model, and we show via simulation that these prescriptions yield near-optimal performance for the underlying stochastic system.

■ MD32

32- North 223- CC

Supply Chain Management for Environmental Sustainability

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Greys Sosic, University of Southern California, Marshall School of Business, Los Angeles, CA, United States of America, sosic@marshall.usc.edu

1 - Complying with Take-back Legislation: A Comparison of Compliance Schemes

Eda Kemahlioglu Ziya, Professor, Kenan Flagler Business School, University of North Carolina, Chapel Hill, NC, 27599, United States of America, Eda_KemahliogluZiya@unc.edu, Gokce Esenduran

Under take-back legislation, manufacturers finance the collection and treatment of their end-of-use products. The most common compliance schemes are by individual manufacturer and collectively with cost allocation by market share. We compare these two schemes, based on cost the manufacturer and on environmental benefits.

2 - Design Incentives, Fairness and Cost Efficiency: A Network Perspective on EPR

Luyi Gui, Georgia Institute of Technology, Atlanta, GA, United States of America, luyi.gui@gatech.edu, Atalay Atasu, Beril Toktay, Ozlem Ergun

Extended Producer Responsibility (EPR) is a policy tool that stipulates the financial responsibility of producers for post-use handling of their products. In this research, we provide an analytical assessment of the potential of the widely-adopted collective EPR implementations for providing design incentives and generating economic benefits for the involved stakeholders via designing cost allocation mechanisms, using a network model of e-waste collection and recycling operations.

3 - Designing Consumer Subsidies with Industry Response for Green Technology Adoption

Maxime Cohen, Massachusetts Institute of Technology, Cambridge, MA, United States of America, maxcohen@mit.edu, Ruben Lobel, Georgia Perakis

We study the problem of designing consumer subsidies for adopting green technologies. We introduce a model where the government sets subsidies to achieve an adoption target level while minimizing its expenditures whereas industry decides production and price to optimize its profit. We derive insights on the impact of demand uncertainty by comparing the optimal policies for stochastic demand to an average case approximation. Finally, we analyze the supply-chain efficiency.

4 - A Stochastic Inventory System with an Emission Constraint

Rowan Wang, University of Minnesota, 111 Church St. SE, Minneapolis, MN, 55455, United States of America, Wang1075@umn.edu, David Chen, Saif Benjaafar

We consider a stochastic inventory problem with a horizon-based emission constraint. We formulate the problem as a stochastic dynamic program and characterize the structure of the optimal policy. We provide managerial insights into the effect of the emission constraint under a variety of settings.

■ MD33

33- North 224 A- CC

Inventory in Manufacturing

Contributed Session

Chair: Rainer Kleber, Otto-von-Guericke University Magdeburg, Faculty of Economics and Management, Universitatsplatz 2, Magdeburg, 39106, Germany, rainer.kleber@ovgu.de

1 - Industry Clockspeed and Manufacturing Inventory

Barin Nag, Professor, Towson University, E-Business & Technology Management, Towson, MD, 21252, United States of America, bnag@towson.edu, Chaodong Han, Dongqing Yao

There is a view that industry clockspeed drives internal operations. We examine Manufacturing inventory levels at different stages, raw material, work-in-process, and finished goods, using operational data for 3-digit NAICS manufacturing industries. Industry clockspeed is linked to manufacturing inventories using multidimensional measures. Results show that clockspeed rates impact manufacturing inventories.

2 - Optimal Replenishment Policy for a Inventory System with One-way Substitution and Fixed Order Costs

Yannick Deflem, KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, yannick.deflem@econ.kuleuven.be, Inneke Van Nieuwenhuyse

We consider a two-product inventory system with one-way substitution, in which the flexible product is used as a backup of the regular product when it stocks out. We analyze the optimal replenishment policy, assuming periodic review and joint fixed order costs.

3 - Inventory Control in Hybrid Manufacturing System with Fixed Set-up Costs

S. Phil Kim, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, ksphil@purdue.edu, George Shanthikumar, Seokcheon Lee

In this paper, the inventory problems in a closed-loop hybrid manufacturing and remanufacturing systems with set-up costs are studied. The set-up costs make it difficult to analyze the optimal structural properties. Recently, Ahiska & King provided practical policy characterizations in separate set-up cost cases. We expand the the problem by including joint & swithing set-up costs and provide integrated approximate policy structures for each type of set-up costs.

4 - Inventory Management in China: An Empirical Study

Jun Shan, Assistant Professor, Nankai University, Business School, Nankai University, 94 Weijin Road, Tianjin, 300071, China, jshan@nankai.edu.cn

In the presence of increased competition from both inside and outside of China, many Chinese manufacturers have turned to scientific management approaches and implemented various enterprise systems. In this study, we apply an econometrical method to investigate the inventories of 1286 firms listed in China. We find that on average the inventory levels have declined over time and that the firm-level data is consistent with several implications derived from classical inventory models.

5 - The Impact of Stock-keeping on Dual-sourcing Strategies with Capacity Reservation and Spot Markets

Rainer Kleber, Otto-von-Guericke University Magdeburg, Faculty of Economics and Management, Universitatsplatz 2, Magdeburg, 39106, Germany, rainer.kleber@ovgu.de, Karl Inderfurth, Peter Kelle

We address a procurement problem of an item used for producing finished goods in a make-to-stock environment under stochastic demand. We consider two sourcing options: the spot market showing stochastic prices and a capacity reservation contract. The contract fixes for a long time the procurement price, a maximum order quantity, and a reservation price. In a numerical study we assess the advantage drawn from dual sourcing compared to single strategies in the context of stock-keeping of material.

■ MD34

34- North 224 B- CC

Feedback, Learning and Innovation

Cluster: New Product Development

Invited Session

Chair: Enno Siemsen, University of Minnesota, 321 19th Ave. S, Minneapolis, MN, United States of America, siems017@umn.edu

1 - Different Feedbacks Different Benefits: Customers and Product Development Process

Bilal Gokpinar, Assistant Professor, University College London, Management Science and Innovation, London, United Kingdom, b.gokpinar@ucl.ac.uk

Companies receive a substantial amount of feedback and learn a lot about their products from the customers after their products are on the market. In this empirical study, we examine the effects of different feedbacks on organizational learning and subsequent design and development efforts.

2 - Patients as Health Care Innovators and Developers of New Treatments, Therapies or Medical Devices

Pedro Oliveira, Professor, Catolica-Lisbon School of Business and Economics, Palma de Cima, Lisboa, 1649-023, Portugal, poliveira@ucp.pt

We empirically investigate the role of patients of chronic diseases in the development of new treatments, therapies or medical devices (TT&DM). We studied a sub-set of diseases (Cystic Fibrosis, Asthma, Sleep Apnea and Diabetes) and found that patients, or their families, have developed about 50% of all TT&DM available. However, the main health-care players have resisted integrating them in their development cycles. Our empirical findings have important policy and managerial implications.

3 - Does Pre-market Approval of Medical Devices Benefit Patients?

Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu, Zhili Tian

We examine whether the FDA Pre-Market Approval (PMA) and 510(K) processes benefit patients using two types of medical devices: spinal implants and stents. In PMA, applicants provide scientific evidence to assure that the device is safe and effective for its intended uses. To quickly get to market, firms often go through 510(K) notification. Without scientific evidence, physicians may either ignore the innovative devices or adopt potentially unsafe devices. In either case, patients suffer.

4 - Collocation Matters:The Interdependence of R&D and Manufacturing

Enno Siemsen, University of Minnesota, 321 19th Ave., S, Minneapolis, MN, United States of America, siems017@umn.edu, John Gray, Gurneeta Vasudeva

Does the collocation of manufacturing and research and development (R&D) activities improve or hurt manufacturing performance? We empirically show that the conformance-quality-related benefits from collocating manufacturing and R&D in the pharmaceutical industry generally dominate the drawbacks, and thus, collocated sites have superior manufacturing quality performance.

■ MD35

35- North 225 A- CC

Pricing Policies and Social Media

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Benny Mantin, University of Waterloo, Waterloo, ON, Canada, bmantin@uwaterloo.ca

1 - Selling to Strategic Consumers: on the Benefits of Valuation Uncertainty and Targeting Capabilities

Dror Hermel, 1004 West Cordova Street, Vancouver, BC, V6E 3T3, Canada, Dror.Hermel@sauder.ubc.ca, Benny Mantin, Yossi Aviv

We study a 2 period model. In the first setting a revenue maximizing seller encounters consumers who are faced with valuation uncertainty. We show that the seller may benefit from encountering strategic rather than myopic consumers. Also, offering a return option can be beneficial. In the second setting the consumers' valuation is certain. The seller can target certain consumers with a discount coupon. In this case we show the adverse effects of strategic consumers can be eliminated.

2 - Customer Revenue Sharing Program in Online Social Media

Fredrik Odegaard, Assistant Professor, Richard Ivey School of Business, 1151 Richmond St. N, London, On, N6G4X3, Canada, fodegaard@ivey.uwo.ca, Fouad H. Mirzaei, Xinghao Yan

Online social media (OSMs) have become a popular and growing phenomenon on the Internet. Given high competition over the Internet to attract users, a question that arises is whether OSMs should reward their contributing users. We model this competition by a duopoly game where users are either active or passive with respect to each OSM. We show this game has a unique Nash equilibrium in pure strategies and specify how OSMs derive the optimal reward payments.

3 - Dynamic Pricing under Demand Uncertainty in the Presence of Patient Consumers

Benny Mantin, University of Waterloo, Waterloo, ON, Canada, bmantin@uwaterloo.ca, Yinhan Meng

We study the effect of consumers' patience on pricing, inventory decisions, and inventory release policies of a monopoly retailer selling a single product over two periods facing uncertain demand. We characterize situations in which the retailer may benefit from the presence of patient consumers; we find the optimal release policy for a given capacity; and we numerically demonstrate capacity decisions to maximize profit.

4 - Social Network Effects on Strategic Customer Behavior: A Laboratory Investigation

Yang Zhang, PhD Student, Pennsylvania State University, 479 Business Building, University Park, PA, 16802, United States of America, yangzhang@psu.edu, Gary Bolton

We examine a coordination game in which each player engages with players directly connected to her in a social network. We identify effects from both global and local network on coordination. Specifically, pooling and separating equilibrium are respectively observed in high and low density networks. Coordination increases with network density and individual connectivity. The observed equilibrium selection pattern can be explained by argument on coordination robustness against strategic risk.

■ MD36

36- North 225 B- CC

On-Demand Dynamic Pricing of Perishable Items in Food and Chemical Industries

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Heping Liu, Senior Science Analyst, SignalDemand Inc., 101 California Street, Suite 1950, San Francisco, CA, 94121, United States of America, hepingliu@yahoo.com

1 - Exploring Research on Methods of Forecasting Product Price of Food Industries

Heping Liu, Senior Science Analyst, SignalDemand Inc., 101 California Street, Suite 1950, San Francisco, CA, 94121, United States of America, hepingliu@yahoo.com

This research made an exploring investigating on the methods of forecasting product prices of food industries. The crucial results are summarized and presented.

2 - A Supply Chain Oligopoly Model for Pharmaceuticals under Brand Differentiation and Perishability

Anna Nagurney, Professor, Univerity of Massachusetts-Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, nagurney@isenberg.umass.edu, Amir H. Masoumi, Min Yu

We propose a generalized network oligopoly model for supply chains of pharmaceutical products. The model captures the Cournot competition among the manufacturers where the consumers differentiate among the products of firms, and the firms take into consideration the discarding costs of perished / wasted products. We investigate the complex challenge faced by the pharmaceutical industry, where an expensive brand loses its dominant market share as a consequence of patent rights expiration.

3 - On the Design of Group Buying Mechanisms

David Yang, The Chinese University of Hong Kong, RM615, M. W. Mong Engineering Building, The Chinese University of Hong Kong, Hong Kong, Hong Kong-PRC, yyyang@se.cuhk.edu.hk

Group buying has gained wide acceptance in recent years. In this talk we try to address the following questions. For a seller, how to choose group buying parameters, such as prices, quantity limits, and time deadlines? When the seller also engages in regular sales, the design of parameters needs to coordinate with the direct channel.

4 - A Prescription for Healthcare Sustainability Focusing on Capability and Affordability

Dennis Mathaisel, Professor, Babson College, Babson Hall, Babson Park, MA, 02457-0310, United States of America, Mathaisel@Babson.edu, Clare Comm

Sustainability is the ability to remain productive long term while minimizing waste and creating value. To be sustainable, the entity or enterprise must possess five "abilities": availability; dependability; capability; affordability; and marketability. This paper focuses on sustainability in the U.S. healthcare industry with an emphasis on its capability and affordability.

■ MD37

37- North 226 A- CC

Competitive Location

Sponsor: Location Analysis

Sponsored Session

Chair: Tammy Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States of America, tdrezner@fullerton.edu

1 - L-SOUP: Location of Socially Undesirable Premises

Vladimir Marianov, Department of Electrical Engineering, The Catholic University of Chile, Santiago, Chile, marianov@ing.puc.cl, H. A. Eiselt

We locate capacitated landfills and transfer stations. waste from any origin can go to a landfill either directly or through a transfer station, where it is compacted and loaded on larger trucks. All garbage disposal needs of a region are fulfilled, while pollution effects over the population are constrained. Pollution from a landfill reaches a distance that depends on its capacity. We present preliminary computational tests.

2 - Issues in Competitive Location Analysis

H.A. Eiselt, University of New Brunswick, P.O. Box 4400, Fredericton, NB E3B 5A3, New Brunswick, Canada, haeiselt@unb.ca, Vladimir Marianov

The presentation considers von Stackelberg solutions of a variety of Hotelling models on a linear market. In particular, we investigate the case of delivered pricing, an asymmetric scenario, in which the duopolists have different objectives, and finally the case of two firms that maximize their respective return on investment.

3 - The p-dispersion Problem: A Unifying Theory

Rick Church, Professor, University of California-Santa Barbara, Santa Barbara, CA, 93106-4060, United States of America, church@geog.ucsb.edu

Erkut and Neuman (1991) proposed a class of four different p-dispersion models. These models covered all of the forms that had appeared in the literature prior to 1991. Since that time much of the work has been concentrated on the refinement of these four model forms. In this paper we present a unifying approach and show that all four models can be formulated as special cases of this unifying model. Computational experience is provided for this general problem and future research is proposed.

4 - A Simulation Based Location of Acoustic Sensors in a Data Fusion Capable Environment

Rajan Batta, University at Buffalo (SUNY), Dept. of Industrial & Systems Engg, Buffalo, NY, 14260, United States of America, batta@buffalo.edu, Alan Blatt, Kevin Majka, Marie Flanigan, Tejswaroop Geetla

In an advanced road system filled with intelligent sensors, we believe that a distributed network of acoustic sensors plays a major role in incident detection and accident characterization. This work looks at the placement of acoustic sensors in a data fusion capable environment to better characterize an incident.

■ MD38

38- North 226 B- CC

Modeling Service Systems

Sponsor: Service Science

Sponsored Session

Chair: Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

1 - How Exactly Does Value Creation Happen in Services? On the Way of Operationalizing SDL

Christoph Heitz, Zurich University of Applied Sciences/Swiss Institute of Service Science, Postfach, Winterthur, 8401, Switzerland, heit@zhaw.ch

Service Dominant Logic (SDL) has become an important paradigm for explaining value creation in services. While the theory seems to be valuable to analyze services, it is still in a very conceptual stage. When viewed with an operational perspective, many questions are not yet solved. In particular it is unclear how value is created over time which, in turn, is relevant for many important decision problems for both firms and clients. We present some thoughts on how SDL can be operationalized.

2 - Abductive and Inductive Reasoning in Service-system Decision Making

Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

This paper begins with a description of the Viable Systems Approach (VSA) as a framework for modeling service systems. The process of abductive/inductive reasoning guides the epistemology and decision-making of agents in a viable service system. We investigate the use of fuzzy logic and fuzzy control systems to model abductive/inductive reasoning. We define different forms of viability and establish conditions for viability based on the performance of fuzzy controls.

■ MD39

39- North 226 C- CC

Strategy in Retail Management

Contributed Session

Chair: Heleno Pioner, Assistant Professor, USP, Av. Prof. Luciano Gualberto, 908, São Paulo, SP, 05508900, Brazil, pioner@usp.br

1 - Assortment Planning for Configurable Products

Ali Taghavi, PhD Candidate, Wayne State University, 4815 Fourth Street, Industrial and System Engineerig Department, Detroit, MI, 48202, United States of America, dz3738@wayne.edu, Ratna Babu Chinnam, Evrim Dalkiran

We develop a framework to find optimal assortment for a manufacturer of configurable products dealing with stock-out substitutions. We suggest a branch and bound approach to solve the mixed-integer nonlinear program, the procedure can solve problems optimally with up to 100 configurations and is being tested by a major automotive OEM.

2 - The Strategic Implications of Seasonal Shopping Queues

Chun Qiu, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, J4Y3G9, Canada, chun.qiu@mcgill.ca, Wenqing Zhang

We investigate two strategic implications of queues in seasonal shopping. We show that, first, a long queue helps retailers effectively segment customers, and target those with lower time costs. Second, a long queue prompts shoppers who decide to join the queue to purchase more. Depending on the trade-off of long term vs. short term profits, a retailer can optimize the queue through operational and promotional decisions.

3 - Retail Staffing in a Competitive Environment

Emre Demirezen, PhD Candidate, Mays Business School, Texas A&M University, College Station, TX, 77843, United States of America, edemirezen@mays.tamu.edu, Subodha Kumar, Natarajan Gautam, Olga Perdikaki

Two retailers compete to capture a market where relative staffing levels affect store traffic. A customer leaves a retailer if she is not served after some time, and may visit the other retailer instead. Each retailer considers revenues from converted traffic, loss of goodwill from reneged customers, and labor cost. We derive the equilibrium staffing levels and analyze the effects of different demand and labor market settings as well as service rates on the staffing levels and profits.

4 - The Effect of Online and Traditional Advertising on Traffic of Retail Stores

Heleno Pioner, Assistant Professor, USP, Av. Prof. Luciano Gualberto, 908, Sao Paulo, SP, 05508900, Brazil, pioner@usp.br, Craig Stacey

We develop a Panel Vector Autoregressive Model to measure the effects of online and traditional media on store traffic. The model addresses the endogeneity of advertising and allows for heterogeneity in effects across markets. Using proprietary data from a large retailer we show that traditional marketing actions have impact on Google searches, store traffic and online store traffic. Moreover, traditional marketing actions appear to have longer effects on store traffic than online advertising.

5 - Strategic Optimization of Split Orders via Assortment Allocation

Andres Catalan, PhD Candidate, The Wharton School, 3730 Walnut St., 500 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, andresc@wharton.upenn.edu, Marshall Fisher

Split orders occur when a customer order has to be fulfilled from more than one distribution center. They can drain an online retailer's profit, especially when pursuing a volume strategy. We study the impact of proactively allocating SKUs to distribution centers and develop and evaluate several heuristics to tackle the problem by using transaction data from one of the leading online retailers in China.

■ MD40

40- North 227 A- CC

Sustainability and Human Factors

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Xu (Cissy) Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 1 Amherst Street, E40-211, Cambridge, MA, 02142, United States of America, xu_yang@mit.edu

1 - Offering New and Remanufactured Products to Strategic Consumers

Ravi Subramanian, Associate Professor, Georgia Institute of Technology, Scheller College of Business, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Ravi.Subramanian@mgt.gatech.edu, Narendra Singh

Using a two-period model, we consider a firm that offers new and remanufactured products to strategic consumers. The firm offers a new product 1 in the first period, and an improved new product 2 and a remanufactured version of product 1 in the second period. We analyze profit-maximizing strategies for the firm under different scenarios.

2 - Take Responsibility of Building an Ethical Supply Chain and the Influence

Yu Xia, Associate Professor, Northeastern University, 214 Hayden Hall, 360 Huntington Ave., Boston, MA, 02115, United States of America, Y.Xia@neu.edu, Xingxing Zu

Manufacturers in the global supply chain is facing tremendous challenge-on one hand, intensified competition and compelling drive for cost containment; and on the other hand, the ever increasing demand of corporate social/ethical responsibility that isn't constrained by geographic and political border. This research proposes a framework to discuss the influence of building an ethical supply chain to a manufacturer's competitive advantage in the global market.

3 - Supply Chain Environmental and Social Sustainability: Determinants and Outcomes

Vincent Hargaden, University College Dublin, School of Mech & Materials Eng, Belfield, Dublin 4, Ireland, vincent.hargaden@ucd.ie, Laoise NicCharthaigh, Donna Marshall

In this paper, we empirically investigate the determinants of environmental and social sustainability in supply chains, such as institutional effects, senior management orientation and uncertainty. Using a path model, we explore the impact that these have on supply chain practices and performance.

4 - Human Factors Study on Sustainable Transportation Technologies and Solutions

Xu (Cissy) Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 1 Amherst Street, E40-211, Cambridge, MA, 02142, United States of America, xu_yang@mit.edu, Ying Wang

We mainly study selected new sustainable transportation technology and informative solution which are driven by users' participation (purchase or adoption). The proposed methodology includes a series of studies on the concept layer, application layer, market layer and effectiveness layer across both macroscopic and microscopic views.

■ MD41

41- North 227 B- CC

Forestry Session I

Sponsor: Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Development and Field-testing of a Forest Fire Detection Decision Support System

David Martell, University of Toronto, 33 Willcocks Street, Faculty of Forestry, Toronto, ON, M5S 1A1, Canada, david.martell@utoronto.ca, Colin McFayden, Douglas Woolford

Forest fire managers seek to find fires while they are small to increase the chance that they will be contained by the initial attack system while they remain small. We describe how subjective assessments of the probability of daily people and lightning-caused fire occurrence and statistical analyses of historical fire occurrence and weather data were combined to develop a fire detection DSS and report on the results of our 2012 field test of the system.

2 - Addressing Adjacency Concerns while Managing Flammable Forest Landscapes

Andres Weintraub, University of Chile, Santiago, Chile, aweintra@dii.uchile.cl, David Martell, Juan Jose Troncoso

We consider problems where uncertain fires can disrupt the satisfaction of adjacency constraints. One cannot harvest stands adjacent to burned stands. Our heuristic accelerates the harvesting of high risk stands. Application of the heuristic to a hypothetical forest increased the value of the harvest while satisfying the adjacency constraints.

3 - A Stochastic, Cellular Multi-objective Forest Harvesting Model with the Risk of Fire

Susete Marques, Technical University of Lisbon, School of Agriculture, Lisbon, Portugal, smarques@isa.utl.pt, Marc McDill, Jose G Borges

Understanding a disturbance like a fire on forest landscapes is a challenge because of complex interactions over a range of temporal and spatial scales. We present a stochastic, cellular multi-objective forest harvest scheduling model incorporating a mechanistic model of fire risk probability based on the state of a cell and the fire risk in neighboring cells.

4 - Finding the Efficient Frontier of a Multiple Criteria Planning Problem in Cork and Holm Oak Forest

Jordi Garcia-Gonzalo, Technical University of Lisbon, School of Agriculture, Forest Research Centre, Lisbon, Portugal, jordigarcia@isa.utl.pt, Vladimir. A Bushenkov, Marc McDill, Jose G Borges

This paper focuses on the use of a decision support system for oak ecosystems' scenario analysis including multiple objectives (e.g.cork production, carbon stocks, protection). The Feasible Goals Method/Interactive Decision Maps (FGM/IDM) technique (applying the Estimation Refinement method) was used to approximate and visualize the Pareto frontier of this multi-criteria optimization problem. Results are discussed for a large-scale application on a cork and holm oak forest in Southern Portugal.

■ MD42

42- North 227 C- CC

Public Transit Modeling

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Nicholas Lownes, Assistant Professor, University of Connecticut, 261 Glenbrook Rd., U-2037, Storrs, CT, 06269, United States of America, nlownes@engr.uconn.edu

1 - Estimating the Optimal Cycle Length for Feeder Transit Services

Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg.-Room 301-I, 3136 TAMU, College Station, TX, 77843, United States of America, quadrifo@tamu.edu

An increase of "livability" depends on solutions to the issue of first/last mile access to transit. We aim to identify the feeder's optimal cycle to maximize LOS. A case study in El Cenizo, TX has been conducted. We are now developing a handy analytical model to obtain results, without relying on extensive simulation analyses. Experiments appear to validate our model, which would allow decision makers to identify the best feeder transit operating design of any given residential area.

2 - Schedule-based Transit Assignment using a Bush-based Approach

Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Hyunsoo Noh

Considering a congested transit network with passenger boarding priority, we propose a schedule-based transit assignment using bush-based approach. The proposed model is applied on a link-based transit schedule network, assuming either deterministic or stochastic passenger behavior. Stochastic behavior is represented with the entropy term for each path. For the solution, an algorithm using a diagonalization technique is utilized.

3 - Enabling Transit Solutions – A Case for Open Data

Kari Watkins, Assistant Professor, Georgia Technology Institute, 790 Atlantic Dr, Atlanta, GA, 30332-0355, United States of America, kari.watkins@ce.gatech.edu

The supply of websites, mobile apps and dynamic displays for transit traveler information has proliferated in the past few years. There are two primary enablers of this trend. This presentation first discusses the impacts of real-time information on riders. It then discusses how open data formatted according to the General Transit Feed Specification as allowed agencies to tap into a growing field of developers who create innovative applications at little cost to the agency.

■ MD43

43- North 228 A- CC

GIS-based Analytical Tools in Railroad

Sponsor: Railway Applications

Sponsored Session

Chair: Clark Cheng, Director Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309, United States of America, clark.cheng@nscorp.com

1 - Map-Based Data Visualization and Business Intelligence Solutions for Transportation

Ravindra Ahuja, President & CEO, Innovative Scheduling, GTEC, 2153 Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States of America, ravi@InnovativeScheduling.com, Jason Montgomery

Visualization of shipment movements and the assets used in these movements on a map is very useful for planning and scheduling activities for transportation carriers. In this talk, we will give demonstrations of several web-based map-based data visualization and business intelligence solutions for railroads which can be easily adapted for other modes of transportation, such as trucking, airlines, and shipping lines.

2 - An Open-architecture GIS Component for Creating Multiband Traffic Density Maps

David Hunt, Oliver Wyman, One University Square, Suite 100, Princeton, NJ, 08540, United States of America, David.Hunt@oliverwyman.com

We will present the architecture behind a GIS mapping component, which was built to generate multiband traffic density maps. Utilizing a web-based, open-architecture design allows this component to be called from nearly any software system that can provide a traffic file and access to a network.

3 - Network Planning Workbench, An Analytical Tool for Monitoring and Improving Operating Performance

Viraj Karnik, Manager Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309, United States of America, viraj.karnik@nscorp.com, Ilya Lavrik

Business analytics improves decision making, it helps to optimize performance by providing new insights. In this talk we present NPW – an analytical tool developed by NS Operations Research for Transportation Planners. NPW provides historical, real time, plan vs. actual comparison information. It is highly interactive, visual and provides user with ability to drill down and perform root cause analysis and decide on corrective actions.

4 - Estimating Customer Service Times using GIS Information

Shantih Spanton, University of Florida, Gainesville, FL, 32611, United States of America, sspanton@ufl.edu, Jagadish Jampani, Joseph Geunes

Currently customer service times are reported manually by crews, leading to potential data entry errors. This project automates the estimation of service times by utilizing onboard GIS data and the customer service sequence. The close proximity of sequentially serviced customers and lack of a precise work location for large industrial customers adds complexity. The derived service times can then be used to optimize local train work load balancing.

■ MD44

44- North 228 B- CC

Supply Chain, Competition

Contributed Session

Chair: Pei-Cheng Liao, Associate Professor, National Taiwan University, No. 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan - ROC, pcliao@ntu.edu.tw

1 - Cooperative Game for Multi-Product Assembly Systems with a Common Component

Cheng-Bang Chen, Department of Industrial and Manufacturing Engineering, The Pennsylvania State University, 424 Waupelani Dr., Apt. N33, State College, PA, 16801, United States of America, czc184@psu.edu, Chia-Wei Kuo

This paper studies cooperative game structures for a single-period multi-product assembly system with a common component. We analyze different forms of coalition that consist of some or all of the suppliers in the channel. We depict the optimal pricing decisions of the suppliers and propose possible coalition structures in the supply chain. Our results document that coalition structures and the manufacturing costs of the suppliers have a profound impact on the optimal wholesale price decisions.

2 - Beyond Price Mechanisms: How Much Can Service Help Manage the Competition from Gray Markets?

Foaad Iravani, PhD Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, foad.iravani.2012@anderson.ucla.edu, Reza Ahmadi, Sriram Dasu

Many companies are challenged by the resale of their products in unauthorized gray markets. Using a game model, we analyze the price and service competition between a manufacturer who operates in two markets and a gray market. We show that the manufacturer uses service to differentiate herself from the gray market and that a little service can go a long way in helping the manufacturer manage the competition from the gray market.

3 - Optimal Order Splitting Ratios for a Two Supplier Case in a Supply Chain Configuration Problem

Gangaraju Vanteddu, Southeast Missouri State University, Cape Girardeau, MO, 63701, United States of America, gvanteddu@semo.edu

By considering order splitting issue as a supply chain configuration problem and cost and responsiveness as the primary order-winners, some very interesting managerial insights are offered with respect to the effect of cost efficient operations and/or location and cost of volume related flexibility at a stage on the optimal ratios of order splitting between two competing suppliers.

4 - Resolving the Knowledge Sharing Dilemma In Supply Chain Innovation Projects: A Game Theory Approach

Eman Nasr, Wilfrid Laurier University, 75 University Avenue West, Waterloo, L5N3C5, Canada, nasr7080@mylaurier.ca, Hamid Noori

Supply chain innovation projects pose a risk of horizontal leakage from vertical sharing of knowledge. Sharing more knowledge increases both innovation-success and knowledge-leakage chances. This presentation addresses this dilemma using a game theoretic approach modeling joint innovation projects in a supply chain linkage (i.e. buyer-supplier) where partners get access to each others knowledge that they can use in other (competing) linkages.

5 - Input Prices as Signals of Uncompetitiveness

Pei-Cheng Liao, Associate Professor, National Taiwan University, No. 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan-ROC, pcliao@ntu.edu.tw

We consider a dual distribution channel in which a vertically integrated manufacturer competes with a downstream rival in a retail market and also the former sells input to the latter. We use a signaling model with a continuum of types to study the case where the manufacturer has private information on its cost. In the separating equilibrium, we show that the manufacturer signals the uncompetitiveness of its firm by charging a smaller input price than the optimal one under complete information.

■ MD45

45- North 229 A- CC

Best of WORMS

Sponsor: Women in OR/MS

Sponsored Session

Chair: Eva Regnier, Naval Postgraduate School, 699 Dyer Road, Monterey, CA, 93943, United States of America, eregnier@nps.edu

Co-Chair: Banafsheh Behzad, PhD Candidate, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, behzad1@illinois.edu

1 - Quantitative Comparison of Approximate Solution Sets for Multicriteria Optimization Problems

Esma Gel, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States of America, esma.gel@asu.edu, Murat Köksalan, John Fowler, Jyrki Wallenius

We consider evaluating the quality of solution sets generated by heuristics for multiple-objective combinatorial optimization problems. We present and demonstrate the use of the integrated preference functional (IPF), which assigns a scalar value to a given discrete set of nondominated points. We present an exact calculation method for the IPF measure for an arbitrary number of criteria and demonstrate the use of IPF with two- and three-criteria numerical examples.

2 - Optimal Supply Diversification under General Supply Risks

Nan Yang, Assistant Professor of Operations and Manufacturing Management, Olin Business School, Washington University in St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130, United States of America, yangn@wustl.edu, Awi Federgruen

We analyze a planning model for a firm or public organization which needs to cover uncertain demand for a given item by procuring supplies from multiple unreliable sources. The planning model determines which of the potential suppliers are to be retained and what size order is to be placed with each. The model considers single-period, multiple-period and infinite horizon settings.

3 - On the Relationship between Risk Preferences and Uncertainty Sets in Robust Optimization

Dessislava Pachamanova, Associate Professor, Babson College, Babson Park, MA, United States of America, dpachamanova@babson.edu

We illustrate the correspondence between uncertainty sets in robust optimization and some popular risk measures in finance and show how robust optimization can be used to generalize the concepts of these risk measures. We show that by using properly defined uncertainty sets in robust optimization models, one can construct coherent risk measures and address the issue of the computational tractability of the resulting formulations. We also review extensions and recent related work in this area.

■ MD46

46- North 229 B- CC

Structural Estimation in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Marcelo Olivares, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, NY, 10027, United States of America, molivares@columbia.edu

Co-Chair: Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu

1 - What's on the Table: Revenue Management and the Welfare Gap in the US Airline Industry

Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vivekf@mit.edu, Yiwei Chen

We present a status quo estimate of total welfare in the US airline industry along with what we believe is the first operationally relevant benchmark for optimal welfare. Our estimates leverage a unique data set on ticket purchases. We show that the welfare gap is surprisingly large, raising the possibility that, moving forward, a combination of innovative selling mechanisms and legislation can make a dramatic difference to airline profitability and consumer satisfaction alike.

2 - Structural Estimation of Callers' Delay Sensitivity in Call Centers

Seyedmorteza Emadi, PhD Student, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, s-emadi@kellogg.northwestern.edu, Baris Ata, Zeynep Aksin, Che-Lin Su

We model callers' decision making process in call centers as an optimal stopping problem. After each period of waiting a caller decides whether to abandon or to continue to wait. The utility of a caller is modeled as a function of his waiting cost and reward for service. We use random coefficient model to capture the heterogeneity of the callers. Using the data of individual calls made to an Israeli call center, we estimate the cost and reward parameters of the callers.

3 - Estimating the Impact of Understaffing on Sales and Profitability in Retail Stores

Saravanan Kesavan, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27519, United States of America, skesavan@unc.edu, Vidya Mani, Jayashankar M. Swaminathan

In this paper we use micro-level data on store traffic, sales and labor from 41 stores of a large retail chain to identify the extent of understaffing in retail stores and quantify its impact on sales and profitability using structural estimation. Aligning staffing levels with changing traffic patterns can result in a 6.15% savings in lost sales and a 5.74% improvement in profitability.

4 - Measuring the Performance of Large-Scale Combinatorial Auctions: A Structural Estimation Approach

Sang Won Kim, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, skim14@gsb.columbia.edu, Marcelo Olivares, Gabriel Weintraub

We develop a structural estimation method to uncover bidders' costs from bidding data in large-scale combinatorial auctions (CAs). We apply the method to the Chilean auction for school meals in which the government procures half a billion dollars worth of meal services every year. Based on the cost estimates, we measure the performance of the CA in terms of cost efficiency and payments to the bidders. We also perform counterfactuals to evaluate alternative mechanisms such as VCG.

■ MD47

47- North 230- CC

Vehicle Trajectory Estimation and Applications

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Zhanbo Sun, Rensselaer Polytechnic Institute, 2162, 14th Street, 2nd Floor, Troy, NY, 12180, United States of America, sunz2@rpi.edu

1 - Computational Methods for Investigating Intradriver Heterogeneity using Vehicle Trajectory Data

Jeffrey Taylor, University of Utah, 5966 West 3500 South, Salt Lake City, UT, United States of America, jeff.d.taylor@utah.edu, Xuesong Zhou

We extend Newell's car-following model to incorporate time-dependent parameters, and use the Dynamic Time warping (DTW) algorithm for model calibration. By synthesizing NGSIM driver trajectory data, we will examine driver heterogeneity in car-following behavior, as well as the driver's heterogeneous situation-dependent behavior within a trip.

2 - Enhancing Vehicle Trajectory Estimation using Airborne Image Data

Zhuoyang Zhou, Arizona State University, 699 S Mill Ave., BYENG MailRoom 523, Tempe, AZ, 85281, United States of America, zhuoyang.zhou@asu.edu, Pitu Mirchandani

The problem that we are addressing is follows: Given macro data (speeds, densities and volumes) on a freeway segment, given some precise data from airborne data, can we reconstruct trajectories of vehicles on the segment. We use the cell transmission model to first develop approximate trajectories which are refined using the image data and a least square estimation model.

3 - Vehicle Trajectory Estimation using Mobile Sensor Data

Zhanbo Sun, Rensselaer Polytechnic Institute, 2162, 14th Street, 2nd Floor, Troy, NY, 12180, United States of America, sunz2@rpi.edu, Jeff Ban

We aim to estimate trajectories of unsampled vehicles from those sample vehicle trajectories around a signalized intersection. The estimated trajectories together with the sample trajectories can provide a more complete picture of the intersection traffic flow. The proposed method is based on the variational formulation for traffic flow.

■ MD48

48- North 231 A- CC

VRP and Applications II

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Joseph Y.J. Chow, Assistant Professor, Ryerson University, 350 Victoria Street, Toronto, ON, M5B 2K3, Canada, joseph.chow@ryerson.ca

1 - Activity-based Travel Scenario Analysis with Routing Problem Reoptimization

Joseph Y.J. Chow, Assistant Professor, Ryerson University, 350 Victoria Street, Toronto, ON, M5B 2K3, Canada, joseph.chow@ryerson.ca

A shared issue with the HAPP and generalized VRP is the computational cost of scenario analysis. Two reoptimization algorithms (solving with prior optimum) are proposed and tested in a computational experiment with 100 zones and 500 synthesized households. Two scenarios are evaluated: a major work destination closes down, and a freeway is added. Results demonstrate effectiveness of reoptimization and ability to re-allocate activities and schedules with respect to spatio-temporal changes.

2 - Local Freight Truck Delivery Planning under Congestion and Emission Considerations

Taesung Hwang, University of Illinois at Urbana-Champaign, Newmark Civil Engineering Lab., MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, hwang7@illinois.edu, Yanfeng Ouyang

It is assumed that a congestion state of each highway segment follows a known probability distribution while local road has identical congestion state. This study deals with the problem of truck driver who decides whether to use highway or local road at each decision point to minimize expected total cost including carbon emission. Dynamic programming approach is adopted.

3 - Hybrid Parallel Metaheuristics for Traveling Salesman Problems with Precedence Constraints

Amelia Regan, University of California, Irvine, CA, United States of America, aregan@uci.edu, Dmitri Arkhipov, Ross Wagoner

Our work studies the effectiveness of implementations of several hybrid metaheuristics implemented on GPUs.

4 - A General-purpose Solver for Multi-attribute Vehicle Routing Problems

Thibaut Vidal, Universitè de Montrèal, Montrèal, QC, Canada, Thibaut.Vidal@cirrelt.ca, Teodor Crainic, Michel Gendreau, Christian Prins

A unified hybrid genetic search is proposed to address multi-attribute vehicle routing problems. This meta-heuristic relies on problem specific route evaluation and assignment components, along with generic implementations of Split procedures, local-search improvement methods, and genetic operators. In addition, a bi-criteria evaluation of individuals, driven by the contribution to the diversity of the population and the solution quality, enables to enhance exploration capabilities and reduce the risks of premature convergence. High-quality results are reported for a wide range of vehicle routing variants.

■ MD49

49- North 231 B- CC

Joint Session TSL/SPPSN: Emergency Preparedness, Disaster Cleanup and Relief

Sponsor: Transportation Science & Logistics & Public Programs, Service and Needs

Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, Technological Institute M235, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Post-disaster Debris Clearance Problem with Information Updates

Melih Çelik, Georgia Institue of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, melihcelik@gatech.edu, Pinar Keskinocak, Ozlem Ergun

The post-disaster debris clearance problem aims to find a sequence for clearance of debris-covered roads under limited capacity so that demand for relief is satisfied in a timely manner. We consider the problem under limited information about debris amounts and assume information is updated as clearance proceeds. We propose heuristic procedures taking into account the trade-off between learning and optimizing, and derive structural results for different learning schemes on structured graphs.

2 - A Two-stage Stochastic Program for Coordination of Disaster Relief Organizations

Luis de la Torre, PhD Candidate, Northwestern University, Technological Institute C236, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, ledelatorre@u.northwestern.edu, Karen Smilowitz, Irina Dolinskaya

Studies of humanitarian operations have found that coordination between relief organizations is challenging to execute but critical for effective assistance. We present a stochastic program for distribution of goods with uncertainty in the accessibility of demand locations. Collaborations are formed in the first stage and multi-day operational decisions are made in the second stage. We discuss insights on the benefits to effective distribution under various limited types of collaboration.

3 - Conditional Value-at-risk for Hazardous Materials Transportation on Time-dependent Networks

Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu, Iakovos Toumazis

We propose new methods for mitigating risk in hazardous materials (hazmat) transportation, based on conditional value-at-risk (CVaR) measure, on time-dependent vehicular networks. While the CVaR risk measure has been popularly used in financial portfolio optimization problems, its application in hazmat transportation has been very recently proposed. The CVaR models are shown to be flexible and general routing models for hazmat transportation, and be solved efficiently.

4 - Network Redesign with Contra-flow in Hurricane Evacuation

Binh Luong, Purdue University, 550 Stadium Mall Drive, G175F, West Lafayette, IN, 47906, United States of America, lthbinhhnvn@gmail.com, Satish Ukkusuri

Given the increasing frequency and severity of hurricanes, it is important to develop efficient strategies for evacuating evacuees. In this work, we present a heuristic approach to redesign the network with limited budget. Both temporal and spatial variations of the contraflow design will be considered. Different scenarios will be tested and compared using an agent based simulation tool.

5 - A Change-point Approach to Estimate Post-disaster Built Environment Recovery

Henry Lester, PhD Candidate, The University of Alabama, Box 870205, Tuscaloosa, AL, United States of America, leste019@crimson.ua.edu

Construction increases in disaster-prone areas dictate disaster planning to safeguard at risk populations during the recovery phase of the disaster life cycle and this planning necessitates a temporal recovery metric. This paper presents a change-point approach to estimating post-disaster built environment recovery. The approach examines spatiotemporal residential construction variability to determine built environment rapidity providing a temporal metric for operative disaster planning.

TSL Poster Session

North Building Foyer

Cluster: TSL Poster

Invited Session

Chair: Elise Miller-Hooks, University of Maryland, College Park, MD, United States of America, elisemh@umd.edu

1 - A Milk Run Model in the Inflow Logistics of Iranian Automobile Manufacturer (Case study)

Ramez Kian, PhD Student, Bilkent University, Bilkent, Central Campus, Cankaya, Ankara, Turkey, ramezk@bilkent.edu.tr, AlirezaHashemi

Automobile manufacturing includes some main production plants and several smaller suppliers where causes to have a sophisticated form of supplying operations in this industry. Moreover, transportation part of the supply chain encompasses massive volume of logistical operations which in turn include large portion of operational costs. Here, a successful experience of implementing Milk-Run concept in the inflow logistics of IKCO, its cost benefits and difficulties will be discussed.

2 - Freight Network Design with Pricing and Economies of Scale

Panagiotis Ypsilantis, PhD. Candidate, RSM, Erasmus University, BurgemeesterOudlaan 50 (Office T9-15), Rotterdam, 3078HB, Netherlands, pypsilantis@rsm.nl, Rob Zuidwijk

The freight service network design in a strategic level is formulated as a bi-level mathematical program; the pricing, design and economies of scale are considered in a competitive environment. The net revenues of a TOC that operates barge and train connections to inland terminals according to the extended gate concept are maximized while the total costs faced by the users of the network are minimized. A solution approach for this problem and some numerical results are presented and discussed.

3 - Integrating Supply Chain Network Model for Auto Industry in Midwest using GIS

Yasaman Kazemi, North Dakota State University, PO box 6050, NDSU UGPTI Dept. 2880, Fargo, ND, 58108, United States of America, yasaman.kazemi@ndsu.edu, Eunsu Lee

This study develops a model for domestic automobile supply chain in the Midwest area based on minimum cost and integrates the cost into highway transportation network. The proposed GIS spatial interaction predicts the optimized flow from origins to destinations by choosing an optimal sequence of routes in order to minimize the total supply chain network cost.

4 - Modelling and Forecasting Maryland Freight Demand

Xiaoyu Zhu, Faculty Research Associate, National Center for Smart Growth, 1226C Preinkert Field House, College Park, MD, 20742, United States of America, xyzhu@umd.edu, Chao Liu

Considering the issues of increase in freight demand because of Panama Canal expansion, opening of Northwest Passage, construction of freight alone corridor and addition of new freight rail tracks, this paper discusses how freight mode and route choice is made to analyse travel behaviour of shippers for a varying range of commodities, dollar value and weight of shipment. Freight Analysis Framework (FAF) data is used to analyze existing shipment.

5 - Offline Share-a-Ride Problem: Taxi Sharing between Passenger and Package

Baoxiang Li, TechnischeUniversiteit Eindhoven, Pav. E.09a, OPAC, Department of IE&IS, Eindhoven, Netherlands, B.Li@tue.nl, Tom Van Woensel, HajoReijers

We propose a multi-commodity sharing system referred to Share-a-Ride problem, mainly design vehicle routes and schedules for a multi-commodity requests. The application of multi-commodity sharing system can raise benefit, reduce cost, and alleviate urban congestion and environment pollution. In this paper, we build an offline model using taxis for both passenger and freight service. The objective function is to minimize a combination of distance saving and convenience fee paid to passengers.

6 - Resource Allocation Model for the Dynamic Control of Material Convergence after Catastrophic Events

Miguel Jaller, Rensselaer Polytechnic Institute, 110 8th St JEC 4037, Troy, NY, 12180, United States of America, jallem@rpi.edu, José Holguín-Veras

We develop a mathematical formulation for the control of material convergence (i.e., flow of supplies and equipment) as to maximize the net benefits extracted from the different flows reaching the impacted area by optimally allocating resources for the tasks of control, handling and processing. This is a multistage access control system that considers the dynamic effects of supply and demand to determine the priority of different items, in order to grant or deny them access to the system.

7 - Using Dynamic Congestion Tolling and V2I Communication for Decentralized Routing

Hao Zhou, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, haozhou@umich.edu

In this research, we consider a traffic network with dynamic congestion toll on each link, and vehicles capable of communicating with central controller. Each vehicle receives real-time toll prices and traffic information of all links, and tries to optimize its route choice based on its own preference. We developed a model to dynamically update toll prices on each link to minimize overall delay of vehicles.

■ MD50

50- North 231 C- CC

Air Force Inventory Delivery

Sponsor: Military Applications

Sponsored Session

Chair: Alan Johnson, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, Wright-Patterson AFB, OH, 45433, United States of America, alan.johnson@afit.edu

1 - Estimating Cargo Airdrop Collateral Damage Risk

Jeffery Cochran, Professor of Operations Research, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, jeffery.cochran@afit.edu, Vincent Cammarano

From real world airdrop scoring data we determine critical factors that affect supply airdrop error and find that bivariate normal distributions characterize cargo airdrop error patterns. Collateral damage risk is estimated by combining numerical integrations of fit bivariate normal distributions across rectangular representations of drop field objects impacted by bundled airdrops as they fall along a linear path.

2 - The Use of Framing in Inventory Decisions

Ken Schultz, Air Force Institute of Technology, Wright-Patterson AFB, OH, 45433, United States of America, kenneth.schultz@afit.edu

People make newsvendor decisions in consistent, sub-optimal ways. Part of this is a reaction to increasing risk with order quantity. We investigate how people respond to framing in the newsvendor problem.

3 - Improving the Robustness of Demand Over Lead-time Calculations

Darryl Ahner, Air Force Institute of Technology, 2905 Hobson Way, WPAFB, OH, 45433, United States of America, darryl.ahner@afit.edu

Demand over lead time calculation using the assumption of normality is well know. Unfortunately, the normality assumption is often violated. This talk discusses a simple yet effective variation of determining point estimates of the mean and variance that increase the robustness of the calculation.

4 - Precision Airdrop: C-5M vs C-17

Alan Johnson, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, Wright-Patterson AFB, OH, 45433, United States of America, alan.johnson@afit.edu

We compare the costs of using the Joint Precision Airdrop System with the C-5M aircraft versus the C-17 platform currently used. Our research question is that the C-5M's greater range and payload capacity renders it a more cost-effective overall delivery platform. To test this hypothesis, we created a spreadsheet-based model that combines planning factors and optimization to estimate the cost associated with a wide range of payloads and mission distances.

■ MD51

51- North 232 A- CC

DIME/PMESII Modeling III

Sponsor: Military Applications

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Value Focused Metrics

David Davis, Co-Director, Peace Operations Policy Program, George Mason University, 3351 Fairfax Dr, Arlington, VA, 22201, United States of America, ddavis@gmu.edu, Daniel Maxwell

Value Focused Metrics (VFM) was developed based upon Ralph Keeney's book, Value Focused Thinking. VFM uses Fundamental Objectives Hierarchies supported by Means Ends Objective Networks as in Keeney's work. Networks are represented as Bayesian and the metrics are identified for outcomes, outputs and inputs thus giving a complete system. The result is an Influence Diagram that can be used to integrate metrics across the levels of the process or as an analytic tool for what if analysis.

2 - Reconciling Multi-strategy Game Theoretic Simulations with Cognitive Dissonance

Jordan Willcox, HSCB Modeling Analyst, System of Systems Analytics, Inc., 11250 Waples Mill Road, Ste 300, Fairfax, VA, 22030, United States of America, jwillcox@sosacorp.com

Game theory is sometimes used to model strategic equilibria for multiple agents, but often the behavior of the agents is dissimilar to human behavior. One example is the contrast between goal maximization and interest in relative agent status. Another is the human bias towards consistent strategies, as captured by the theory of cognitive dissonance. The author considers modifications that address these issues, and discusses integrating a cognitive dissonance model into a game-theoretic model.

3 - Understanding the Instruments of National Power through a System of Differential Equations

Cade Saie, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, Cade.Saie@afit.edu, Darryl Ahner

Motivated by the modeling of attrition warfare using Lanchester equations, we develop of a functional form of a system of differential equations; describe the methodology which populates and solves this system; and demonstrate the results obtained through an application of the process using open source data from Iraq. This system captures the changes in measures of merit used to evaluate the effects of leveraging the instruments of national power in nation-building operations.

4 - Epidemiological Modeling in Sparse Data Environments: An Approach to Data Collection and Analysis

Joel Alejandre, Naval Research Laboratory, 4555 Overlook Ave., SW, Washington, DC, 20375, United States of America, joel.alejandre@nrl.navy.mil, Roger Hillson

In austere environments with limited network-coverage and poor medical record systems, a platform is needed for collecting and geographically contextualizing health data to assist pathogenic outbreak detection. A Sierra Leone use-case illustrates data collection (demographic, health, and physical features); utilization of population estimation products for data-normalization; and health reporting over mobile networks. This analysis will facilitate the judicious deployment of medical resources.

■ MD52

52- North 232 B- CC

Reserve Requirements and Zone Partitioning in Electric Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Kory Hedman, Assistant Professor, Arizona State University, P.O. Box 875706, GWC 206 School of ECEE, Tempe, AZ, 85287-5706, United States of America, kory.hedman@asu.edu

1 - Power Network Partitioning via Electrical Distance

Seth Blumsack, Pennsylvania State University, 124 Hosler Building, University Park, PA, 16802, United States of America, sethb@psu.edu

We outline a method for partitioning electrical networks based on a measure of electrical coheseiveness as our primary measure of partition quality. The method can be implemented easily on large systems using a novel genetic algorithm, and we illustrate our partitioning method on a small test network and a representation of the Polish transmission grid. We also present a power-flow based example application of the usefulness of our proposed method for defining analysis zones in a power system.

2 - A Mathematical Program to Determine Reserve Zone Partitions

Joshua Lyon, PhD Student, Arizona State University, 31000 N Silver Bullet Trl, San Tan Valley, AZ, 85143, United States of America, joshua.lyon@asu.edu, Kory Hedman, Muhong Zhang

Reserve requirements are used to ensure reliability in electric power systems since endogenously modeling all N-1 contingencies is too computationally burdensome. Reserve zones ensure that reserves are dispersed across the network in order to ensure deliverability. This research develops a mathematical program to determine zone partitions for day-ahead unit commitment models while considering the impact on market economics and reliability. Results based on IEEE test cases will be presented.

3 - Determining Reserve Zone Requirements from the Energy and Ancillary Service Co-optimization

Yonghong Chen, Consulting Engineer, MISO, 720 City Center Drive, Carmel, IN, 46077, United States of America, ychen@misoenergy.org, Paul Gribik

A new approach was proposed and implemented at MISO to address the reserve deliverability issue. MISO enhanced the co-optimization process so that it can evaluate the impact that deploying cleared reserves on a zonal basis would have on specified transmission constraints. Reserve zone requirements are solved to meet both market-wide reserve requirements and deliverability requirements. MISO is looking at a more comprehensive solution in which procurement of reserves is modeled on a nodal basis.

4 - Contingency-based Zonal Reserve Modeling and Pricing in a Co-optimized Energy and Reserve Market

Tongxin Zheng, Technical Manager, ISO New England, 1 Sullivan Road, Holyoke, MA, 01106, United States of America, tzheng@iso-ne.com, Eugene Litvinov

This paper presents the market clearing framework for the co-optimized real-time energy-reserve market implemented in the ISO New England. In this co-optimized market clearing model, reserve products are procured on a zonal basis based on system and local contingency protection criteria. The zonal reserve model is derived from the worst contingency event in the reserve zone and ensures reserve deliverability among reserve zones.

■ MD53

53- North 232 C- CC

Integration of Uncertainty Modeling and Stochastic Optimization for Energy Applications

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Victor Zavala, Argonne National Laboratory, Mathematics & Computer Science Division, Chicago, IL, 60439, United States of America, vzavala@mcs.anl.gov

1 - Higher-order Confidence Intervals for Stochastic Programming using Bootstrapping

Cosmin Petra, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, Il, 60439, United States of America, petra@mcs.anl.gov, Mihai Anitescu

Traditional methods for the statistical inference of stochastic optimization problems require a large number of samples to obtain accurate uncertainty estimates on the solution. For complex energy systems incorporating weather-related uncertainty, an extensive weather sampling becomes prohibitive due to the associated high cost. In this talk, we present a novel high-order bootstrapping method that provides reliable confidence regions in the presence of a small number of samples.

2 - Gaussian Process Modeling for Measurement and Verification of Building Energy Savings

Yeonsook Heo, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, United States of America, yheo@anl.gov, Diane Graziano, Victor Zavala

Measurement and verification (M&V) can add significant cost to building energy efficiency projects and often produce energy savings evaluations that lack credibility. We introduce an improved M&V method applying Gaussian Process (GP) modeling that can, using less measured data, capture nonlinear energy behavior and quantify prediction uncertainty. A case study demonstrates the strengths of GP models for M&V and further explores their potential for analyzing different time resolution data.

3 - Multi-scale Stochastic Optimization for Integrating Wind Simulation

Suvrajeet Sen, Professor, University of Southern California, Epstein Department of ISE, Los Angeles, CA, United States of America, sen.22@osu.edu, Victor Zavala, Harsha Gangammanavar

We present a stochastic optimization model in which decisions for wind generation are implemented at a far greater pace than those for thermal units. This multi-scale model adopts a combination of approximate dynamic programming and stochastic decomposition (ADP/SD) to accommodate the different time-scales. Our computational results are based on injecting wind simulations into the ADP/SD algorithm.

4 - Calibration of Building Energy Model under Uncertainty

Huafen Hu, Assistant Professor, Portland State University, 1930 SW 4th Ave., Room 400, Portland, OR, 97201, United States of America, hu@cecs.pdx.edu

Calibrated building model is playing a more significant role in building retrofit and control but yet remains to be an art rather than a science due to the inherent nonlinearity and uncertainty in building behavior. This study presents a simple but effective Monte Carlo approach that delivers calibrated building models by a walk-through audit. A university building is used to demonstrate the strength and robustness of the approach to unavoidable noise/disturbance in building model calibration.

■ MD54

54- Regency Ballroom A- Hyatt

Panel Discussion: Town Hall Meeting with the Editorial Board of Operations Research

Cluster: INFORMS Journals Cluster

Invited Session

Chair: Stefanos Zenios, Professor, Stanford Graduate School of Business, 655 Knight Way, Stanford, United States of America, stefzen@GSB.Stanford.Edu

1 - Town Hall Meeting with the Editorial Board of Operations Research

Moderator: Stefanos Zenios, Professor, Stanford Graduate School of Business, 655 Knight Way, Stanford, United States of America, stefzen@GSB.Stanford.Edu, Panelists: Beril Toktay, Edieal Pinker

Members of the editorial board of Operations Research will discuss both the areas that are historically covered by the journal, as well as initiatives to cover new "growth" areas. The audience will have the opportunity to learn about Special Issues and ask questions about the journal, its strategy, and the process of reviewing and revising papers.

■ MD55

55- Regency Ballroom B - Hyatt

Joint Session OR in Emerging Econ/Enre-Energy: OR Applications in the Energy Sector of Emerging Markets

Cluster: Operations Research in Emerging Economies & Energy, Natural Res & the Environment/Energy

Invited Session

Chair: Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, São Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br

1 - On Approaching Upstream and Downstream Logistic Problems at Petrobras

Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, São Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br, Daniel F. Ferber, Daniel G. E. Trovo

We present two operations research applications in logistic problems faced by Petrobras. The first concerns the scheduling of rigs and vessels to develop offshore oil wells. It involves the assignment and scheduling of resources to developments, resource maintenance and loading of inventory. The second is related to the transference planning of oil refined commodities on a pipeline network. It comprises tactical aspects such as capacity for in-transit inventory, transit time and flow reversal.

2 - Optimizing Crude Oil Supply Chain Decisions with Policy Impact: A Case Study of Ghana

Iddrisu Awudu, North Dakota State University, 26 University Village, Fargo, ND, 58102, United States of America, Iddrisu.Awudu@my.ndsu.edu, Jun Zhang

This study will integrate supply chain decisions optimization and governmental policies. Challenges such economic and political issues within a newly discovered oil well under production are crucial to all parties involved. This stud analyzes a crude oil production company using chance constraint programming to measure the level of satisfaction the firm places on its profit margin, while fulfilling governmental policies. The results conclude a firm can combine both and have a solid outlook.

3 - An Economic Analysis of Brazil Fuel Policies, Consumption and Choice of Fuel, and Emission Impacts

Hector Nunez, Universtiy of Illinois, nunez5@illinois.edu, Hayri Onal

We use an economic equilibrium model to analyze the impacts of recent changes in Brazil fuel policies and strong demand in world sugar markets. We simulate consumers' driving demand and fuel choices in response to the reduced blend rate and taxes, and determine land use changes, GHG emissions, and welfare implications. Our results show that despite the reduction in driving demand, GHG emission from Brazil would increase significantly due to the consumption of a more carbon intensive fuel blend.

4 - Low-Carbon Development of the Nigerian Power Sector: The Role of Off-Grid Generation in Leapfrogging

Surya Swamy, Consulting Decision Analyst, Lumina Decision Systems, 26010 Highland Way, Los Gatos, Ca, 94117, United States of America, surya@lumina.com, Max Henrion

Nigeria's Power Sector has grappled with electricity shortages and unreliability of supply over the last two decades, which have prevented the country from realizing its full economic growth potential. In this World Bank funded study, we explore how Nigeria could leapfrog traditional development pathways by embracing an alternative model for low-carbon development in which distributed generation and renewables play a major role.

■ MD56

56- Curtis A- Hyatt

Joint Session TMS/NPD: TMS Distinguished Speaker

Sponsor: Technology Management & New Product Development

Sponsored Session

Chair: Juliana Hsuan, Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, jh.om@cbs.dk

1 - An Ecology of Innovation

James Utterback, Massachusetts Institute of Technology, Cambridge, MA, United States of America, jmu@mit.edu

Amid an increasingly diverse and chaotic scene of changing markets and widening competition, I will argue for thinking of innovation and firm formation as a process of experimentation in the market. Rather than seeking to reduce uncertainty and to optimize, we should seek to increase possibilities for experimentation and for broader search and synthesis.

■ MD57

57- Curtis B- Hyatt

Advances in Stochastic Optimal Control and Learning I

Sponsor: Applied Probability

Sponsored Session

Chair: Ciamac Moallemi, Associate Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10025, United States of America, ciamac@gsb.columbia.edu

Co-Chair: Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vivekf@mit.edu

1 - New Sampling Schemes for Simulation-based Approximate Dynamic Programming

Dimitri Bertsekas, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, dimitrib@mit.edu, Huizhen Yu

Existing multistep methods in temporal difference (TD) learning often use a single long trajectory. We propose much more flexible sampling schemes. They are connected with weighted Bellman equations, which broadly generalize the TD(lambda) approximation framework. We provide a convergence analysis, and we review a variety of useful schemes in the context of policy evaluation and policy iteration with exploration enhancements.

2 - Q-Learning Algorithms and their Convergence in Total Cost Problems of Stochastic Shortest Path Type

Huizhen Yu, Massachusetts Institute of Technology, Laboratory for Information and Decision, 77 Massachusetts Avenue, 32-D558, Cambridge, MA, United States of America, janey_yu@mit.edu, Dimitri Bertsekas

Q-learning is an asynchronous stochastic iterative algorithm for solving Markov decision processes (MDP) or two-player zero-sum stochastic games. Its convergence in the total cost case was known earlier under restrictive conditions that ensure boundedness of iterates. We show that such conditions can be removed for MDP and stochastic games of the stochastic shortest path (SSP) type. This convergence result applies also to a new policy iteration-like Q-learning algorithm for SSP problems.

3 - A Brownian Model of Dynamic Pricing with Demand Model Uncertainty

N. Bora Keskin, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu

We propose a Brownian formulation to address the tradeoff between learning and earning in a dynamic pricing problem that involves demand model uncertainty. We characterize the optimal solution of the Brownian formulation to provide guidelines to implement price experimentation in practice.

■ MD58

58- Phoenix East- Hyatt

Queueing and Pricing

Sponsor: Applied Probability

Sponsored Session

Chair: Mor Harchol-Balter, Associate Professor, Carnegie Mellon University, 5000, Forbes Avenue, Computer Science Department, Pittsburgh, PA, 15213, United States of America, harchol@cs.cmu.edu

Co-Chair: Mustafa Akan, Assistant Professor of Operations Management Tepper School of Business Carnegie Mellon University, Pittsburgh, PA, 152123, United States of America, akan@cmu.edu

1 - The Optimal Admission Threshold in Observable Queues with State Dependent Pricing

Sherwin Doroudi, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, sdoroudi@andrew.cmu.edu, Christian Borgs, Jennifer Chayes, Mor Harchol-Balter, Kuang Xu

We consider a model where delay sensitive customers seek service from a server with an observable queue. It is known that in this setting revenue is maximized by a state dependent pricing policy with a threshold, whereby customers are barred from entry once the queue reaches a certain length. We are the first to find the optimal threshold in closed form. Our closed form uses the Lambert W function and leads to a very simple formula for optimal revenue.

2 - Provisioning of Large Scale Systems: The Role of Network Effects and Anarchy in the User Base

Jayakrishnan Nair, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, ujk@caltech.edu, Adam Wierman, Bert Zwart

We consider the problem of capacity provisioning for an advertising-supported online service by analyzing the strategic interaction between the service provider and the user base. We show that stronger positive network effects and non-cooperation in the user base drive the service into a more congested state, leading to increased profit for the service provider. However, the impact of non-cooperation, or 'anarchy' in the user base strongly dominates the impact of network effects.

3 - Fixed and Market Pricing for Cloud Services

Ian Kash, Microsoft Research, 7 JJ Thomson Ave., Cambridge, CB3 0FB, United Kingdom, iankash@microsoft.com, Vineet Abhishek, Peter Key

This paper considers two simple pricing schemes for selling cloud instances and studies the trade-off between them. We characterize the equilibrium for the hybrid system where arriving jobs can choose between fixed or the market based pricing. We provide theoretical and simulation based evidence suggesting that fixed price generates a higher expected revenue than the hybrid system.

■ MD59

59- Phoenix West- Hyatt

Stochastic Impulse/Singular Control Models and Methods

Sponsor: Applied Probability

Sponsored Session

Chair: Kumar Muthuraman, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, United States of America, kumar@austin.utexas.edu

1 - Inventory Control with a Cash Register: Sales Recorded but Not Demand or Shrinkage

Metin Cakanyildirim, Associate Professor of Operations Management, University of Texas at Dallas, P. O. Box 830688, Richardson, TX, 75080-0688, United States of America, metin@utdallas.edu, Meng Li, Suresh Sethi, Alain Bensoussan

Inventory is subject to unobserved shrinkages happening both before and after the demand realization and it is inaccurate. Our objective is to minimize the expected discounted cost related to inventory holdings and shortages over an infinite horizon. We obtain a lower bound on the cost analytically and develop an iterative algorithm, and compare its solution to a myopic solution.

2 - Short Rate Control and Implied Yield Curves

Haolin Feng, Assistant Professor, Sun Yat-sen University, 135 Xing Gang Xi Road, Lingnan College, Guangzhou, 510275, China, FengHaoL@mail.sysu.edu.cn, Kumar Muthuraman, Daniel Mitchell

We consider a problem where the central bank has a target short rate level. Running costs are incurred as the short rate deviates from the target level. Each intervention of the central bank incurs some costs which have a fixed and a variable component. The objective of the central bank is to minimize the total expected costs. We solve the resulting impulse control problem for various short rate dynamics and study how the yield curves of different models are impacted under impulse control.

3 - Impulse Controls on Jump Diffusions

Xin Guo, University of California-Berkeley, Berkeley, CA, United States of America, xinguo@ieor.berkeley.edu

We discuss the general DPP for impulse control problems of jump diffusions, as well as the regularities of the value functions for the control problems.

■ MD60

60- Remington- Hyatt

Airline Pricing and Customer Choice

Sponsor: Aviation Applications

Sponsored Session

Chair: Laurie Garrow, Associate Professor, Georgia Institute of Technology, School of Civil Engineering, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu

1 - The Effect of Advanced Purchase Deadlines on Airline Customer Behavior

Susan Hotle, Graduate Research Assistant, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, slhotle2@yahoo.com, Laurie Garrow, Matt Higgins

It has become critically important for airlines to understand how shopping on the internet allows consumers to search for information and what factors influence their purchase decisions. Most literature assumes that customers can search for an infinite amount of time and fails to account for the presence of advanced purchased deadlines which signal price increases. This research looks at the how advanced purchase deadlines affect the online search and purchase behavior of airline customers.

2 - Controlling for Price Endogeneity in Airline Passenger Itinerary Choice Models

Stacey Mumbower, Graduate Research Assistant, Georgia Institute of Technology, Atlanta, GA, United States of America, stacey.mumbower@gatech.edu, Laurie Garrow

Although price endogeneity can lead to unrealistic and misleading model coefficient estimates, few studies have explored endogenous airline prices. A unique set of data collected from airline websites is used to build airline passenger itinerary choice models. An instrumented variable approach is used to control for factors that influence price (such as prices of other competitors and presence of a low cost carrier), allowing models to estimate the unbiased effect of price on consumer decisions.

3 - An Optimum Pricing Policy for a Multiclass Problem in the Airline Industry

Daniel Felipe Otero Leon, Lecturer, Universidad de los Andes, Cra 1 Este #19A -40, Bogota, 00, 1111, Colombia, df.otero128@uniandes.edu.co, Raha Akhavan-Tabatabaei

In the airline industry, deciding the price of a ticket directly affects the future demand to buy that ticket. Depending on the willingness to pay of the customers, seats could remain empty or sold at a lower price at the departure date. We propose a stochastic dynamic pricing model to optimize the revenue of a given flight, applying phase type distributions and renewal processes to estimate the inter-arrival process and the probability that a customer buys a ticket.

■ MD61

61- Russell- Hyatt

Analyzing Security Against Adaptive Adversaries

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: Henry Willis, RAND Corporation, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States of America, hwillis@rand.org

1 - Using Pattern Analysis and Systematic Randomness to Allocate Border Security Resources

Henry Willis, RAND Corporation, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15213, United States of America, hwillis@rand.org, Joel Predd

The U.S. Office of Border Patrol is investigating how pattern and trend analysis and systematic randomness can be used to position border security resources. This study examined how approaches that combine these two techniques yield higher interdiction rates than approaches using either technique alone, and it identifies circumstances in which combined approaches are competitive with perfect surveillance.

2 - Has Terror Gone to Ground?

Arnold Barnett, Professor, Massachusetts Institute of Technology, E62-568, MIT, Cambridge, MA, 02478, United States of America, abarnett@mit.edu

Since 9/11, efforts to thwart terror against transportation systems have focused on airplanes. Recently, however, the vast majority of successful attacks on transportation have victimized subways, commuter trains, and long-distance rail services. We discuss the recent data and their implications.

3 - Games and Risks: Some National Security Issues and Comparison of Analytic Frameworks

Elizabeth Pate-Cornell, Stanford University, Palo Alto, CA, United States of America, mep@stanford.edu

An overview of studies in the Stanford engineering risk research group on the use of game analysis in risk assessment with applications to national security problems involving counter-terrorism, nuclear non-proliferation startegies and warnings from the intelligence community.

4 - Attacker-defender Games and Decisions

Detlof von Winterfeldt, University of Southern California, Los Angeles, CA, United States of America, detlof@sppd.usc.edu

Using game and decision theory to model attacker defender interactions has been an important recent development to assess terrorism risks. I will give a brief overview of alternative attacker-defender models and provide examples from nuclear detection and surface-to-air missile defenses.

■ MD62

62- Borein A- Hyatt

Competition in Network Markets

Cluster: Auctions

Invited Session

Chair: Thanh Nguyen, Northwestern University, Kellogg School of Management, 2001 Sheridan Rd, Evanston, IL, United States of America, t-nguyen@kellogg.northwestern.edu

1 - Energy Procurement Strategies in the Presence of Intermittent Sources

Sachin Adlakha, Caltech, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, adlakha@caltech.edu, Adam Wierman, Jayakrishnan Nair

The increasing penetration of renewable energy sources, such as wind energy, pose significant challenges for utility companies. In this talk, we discuss inventory management issues that arise in the presence of renewable resources. A key insight from our work is a separation between the impact of the structure of electricity markets and the impact of increased penetration.

2 - Investment and Competition in Unlicensed Spectrum

Randall Berry, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, rberry@eecs.northwestern.edu

Increasing the amount of unlicensed spectrum for wireless services, such as the recent opening of the television white spaces in the US, has the potential to benefit customers by increasing competition, but may also increase congestion. We give a model for studying such trade-offs and consider the implications of adding such spectrum in terms of the investment and pricing decisions of wireless service providers.

3 - The Cost of Free Spectrum

Thanh Nguyen, Northwestern University, Kellogg School of Management, 2001 Sheridan Rd, Evanston, IL, United States of America, t-nguyen@kellogg.northwestern.edu

The FCC has recently increased the amount of spectrum available for wireless services by permitting unlicensed access to television whitespaces. While this additional unlicensed spectrum allows for market expansion, it also influences competition among providers and increase congestion among consumers of wireless services. We find that the social and consumer welfare depends on the amount of additional unlicensed spectrum, can actually decrease over a significant range of unlicensed bandwidths.

4 - Mechanism Design Approach to Electricity Markets

Luciano De Castro, Northwestern University, 2001 Sheridon Road, Evanston, IL, United States of America, l-decastro@kellogg.northwestern.edu

The standard framework to electricity markets is that of competitive markets, somehow adjusted to take in account eventual market power. In this framework, electric energy is just a homogenous good, to be negotiated in a spot market. Although contracts could be written for future delivery, this is just a consequence of the risk aversion of the players, since price variance can be significant. We propose a different way of looking at electricity markets: one given by mechanism design.

■ MD63

63- Borein B- Hyatt

Behavioral Operations Management

Sponsor: Behavioral Operations

Sponsored Session

Chair: Yaozhong Wu, National University of Singapore Business School, 15 Kent Ridge Dr., Singapore, Singapore, yaozhong.wu@nus.edu.sg

1 - Behavioral Project Management: Motivating Workers to Meet Project Deadlines

Fabian Sting, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, FSting@rsm.nl, Dirk Stempfhuber, Christoph Loch

A fundamental problem in project management is meeting deadlines under uncertainty and project workers with private information. We present a case study of a company that has developed a project management system that addresses human behavior. Resulting from this evolution into a "behavioral project management system", the company's project performance improved. Our findings demonstrate the importance behavior in project management and suggest approaches to effectively guide behavior.

2 - On a Queueing System with State-dependent Service Rate

Xiaobo Zhao, Professor, Tsinghua University, IE Department, Qinghuayuan, Beijing, 100084, China, xbzhao@tsinghua.edu.cn, Hao Zhang, Qi-Ming He

We conduct a laboratory experimental study on some service systems. Results indicate that the service rate of a server (i.e., a subject) depends on the number of customers in the queue, which is typically non-monotone. Taking such state-dependent service into consideration, we introduce an M/M/1 type queueing model and analyze the effect of the state-dependent service on system performance.

3 - Distributional and Peer-induced Fairness in Supply Chains

Yaozhong Wu, National University of Singapore Business School, 15 Kent Ridge Dr., Singapore, Singapore, yaozhong.wu@nus.edu.sg, Xuanming Su, Teck-Hua Ho

We study how different forms of fairness concerns affect pricing decisions in supply chains whose members exhibit distributional fairness between upstream suppliers and downstream retailers as well as peer-induced fairness among retailers. We analyze how the supplier should make price offers to retailers in the presence of both types of fairness concerns. We also conduct an experimental study and provide evidence of the impact of both fairness concerns.

4 - Contingent Pricing in the Presence of Loss Averse Consumers with Stochastic Reference Points

Sami Najafi-Asadolahi, Rotman School of Management, University of Toronto, Toronto, Canada, Sami.Najafi@rotman.utoronto.ca, Opher Baron, Ming Hu

We study a setting in which over repeated sales horizon a firm sells a product to a market with two types of consumers: regular consumers, who have a given valuation for the product and whose market size is uncertain; and bargain hunters, who have a lower valuation and are abundant. The regular consumers are loss-averse with stochastic reference points that reflect their experiences with historic prices. We show that the firm's optimal policy is a contingent pricing policy in a threshold form.

■ MD66

66- Ellis West- Hyatt

Topics in Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Haibing Lu, Assistant Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95050, United States of America, hlu@scu.edu

1 - Community Discovery and Profiling with Social Messages

Wenjun Zhou, Assistant Professor, University of Tennessee, 247 Stokely Management Center, 916 Volunteer Blvd, Knoxville, TN, 37996, United States of America, wzhou4@utk.edu, Hongxia Jin, Yan Liu

With the popularity of social media, it is of great interest to discover communities and utilize them for effective social communications and collaborations. Existing work has shown prospects of modeling contents and social links. Nonetheless, the definition of a community varies. We believe that a community depends not only on people, but also the topics they are communicating about. In this paper, we automatically find and profile users' communities with a model based on Bayesian modeling.

2 - Accurate and Efficient Query Clustering via Top-K Search Results

Yuan Hong, PhD Candidate, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, yhong@cimic.rutgers.edu, Jaideep Vaidya, Haibing Lu

Search engine query clustering has attracted significant attention recently. Since they are usually incomplete, ambiguous and diverse, most clustering methods cannot guarantee good performance. We propose an efficient and accurate approach to cluster diverse queries based on their ranked top-k URLs returned by the search engine. The experimental results show that our method can generate more precise clusters, with remarkably improved efficiency/scalability and robust parameter tuning.

3 - Cost-aware Collaborative Filtering for Travel Tour Recommendations

Yong Ge, PhD. Student, Rutgers University, 1 Washington Street, Newark, NJ, 71012, United States of America, yongge@pegasus.rutgers.edu, Hui Xiong

Advances in tourism economics have enabled us to collect massive amounts of travel tour data. If properly analyzed, this data can be a source of rich intelligence for the provision of travel tour recommendations. However, tour recommendation is quite different from traditional recommendations, because the tourist's choice is directly affected by the travel cost, which includes the financial cost and the time. In this paper, we provide a focused study of cost-aware tour recommendation.

4 - Unfixed Clusterwise Linear Regression

Haibing Lu, Assistant Professor, Santa Clara University, 500 El Camino Real, Santa Clara, CA, 95050, United States of America, hlu@scu.edu

Clusterwise linear regression (CLR) considers data points are generated by multiple linear models. Most CLR approaches simply assume that multiple linear models to be discovered have the same explanatory variables and differ only in coefficients. However, it is often the case that different clusters have different exploratory variable sets. How to effectively and efficiently identify clusters with their respective explanatory variable sets from large scale observations is our interest.

■ MD67

67- Ellis East- Hyatt

Reliability in Integrated Manufacturing and Service Systems

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, United States of America, tj17@txstate.edu

Co-Chair: Haitao Liao, Associate Professor, University of Arizona, Tucson, AZ, 85721, United States of America, hliao@email.arizona.edu

1 - Performance-based Maintenance and Logistics Service: Parts Availability or Operational Availability?

Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, United States of America, tj17@txstate.edu

Performance-based contracting is envisioned to produce the necessary levels of reliability at the reduced cost. We study a multi-echelon and multi-item service delivery network. We present a unified operational availability model comprehending eight drivers, including reliability, usage, spares, maintenance, fleet size, touch labor, repair and reconditioning turn-around times. Contradictory to the common belief, high operational availability can be sustained under near-zero spares inventory.

2 - Prediction of Warranty Repair Demand Considering New Sales and Failed-but-not-reported Phenomena

Haitao Liao, Associate Professor, University of Arizona, Tucson, AZ, 85721, United States of America, hliao@email.arizona.edu, Wei Xie

In this paper, we present a mathematical model for predicting warranty repair demands for a new product covered by a non-renewable free minimal-repair warranty policy. We consider that the installed base of the product varies with time due to both new sales and units being taken out of service. In particular, failed-but-not-reported phenomena with time-dependent warranty claim probability are considered.

3 - A Method for Reliability Analysis and Optimization of Hybrid Energy Systems

Zhigang Tian, Concordia University, 1515 Ste-Catherine Street West, Montreal, Canada, tian@ciise.concordia.ca, AmirAhmad Seifi

A hybrid energy system integrates renewable energy sources like wind, solar, micro-hydro and biomass, fossil fuel power generators and energy storage. In this work, we develop a method to analyze reliability of hybrid energy systems considering uncertainties and time-varying characteristics in various power sources and the demand, and to optimize the system design to minimize the system cost and improve system reliability.

4 - An Efficient Method for Fatigue and Fracture Analysis with Uncertainity Quantification

Qingyu William Yang, Assistant Professor, Wayne State University, 4815 Fourth Street, Rm 2167, Detroit, MI, 48335, United States of America, qyang@wayne.edu, Nailong Zhang

Fatigue damage is defined as material fails due to repeated application of loads that are not large enough to cause failure in one single application. We developed an efficient statistical model to capture the model uncertainty for fatigue and fracture analysis. A case study is conducted to verify the proposed method.

5 - A POMDP for Maintenance Optimization with a Heterogeneous Population of Spare Components

C.D van Oosterom, PhD Student, Eindhoven University of Technology, P.O. Box 513, Opwettensemolen 62, Eindhoven, 5600MB, Netherlands, C.D.v.Oosterom@tue.nl, Geert-Jan van Houtum, Hao Peng

We develop a partially observable Markov decision process (POMDP) model that incorporates component heterogeneity in adaptively scheduling inspections and replacements for deteriorating systems. As the likelihood of observing a certain sequence of degradation levels will be affected by the component type (strong or weak), inspections and replacements can be adapted to the belief about the component type. We evaluate the according reduction in total expected discounted costs in a numerical study.

■ MD68

68- Suite 312- Hyatt

Market Crashes

Sponsor: Financial Services Section

Sponsored Session

Chair: Olympia Hadjiliadis, Associate Professor, Brooklyn College and the Graduate Center, CUNY, 2900 Bedford Ave, Brooklyn, NY, 11209, United States of America, ohadjiliadis@brooklyn.cuny.edu

1 - Modeling Stochastic, State-Dependent Correlations

Adam Metzler, Assistant Professor, University of Western Ontario, London, ON, Canada, ametzle@uwo.ca

Empirical evidence indicates that financial assets tend to be most sensitive to systematic risk factors when these factors take on adverse values. Unfortunately this relationship is not accounted for in many standard approaches to modeling stochastic correlation, most notably in simple mixture models. In this talk we introduce a novel family of correlation models that explicitly accounts for this type of state-dependence, and contains both the simple mixture and RFL models as extreme cases.

2 - Optimal Stopping to Prevent a Catastrophic Event
H. Dharma Kwon, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu

We consider the stopping problem of a decision-maker facing a catastrophic event with weak forewarning signals. We are particularly interested in the case the event is extremely rare and the occurrence of the event is extremely costly. The optimal policy is to stop when the posterior probability of the event exceeds an optimally chosen threshold. We also comment on stopping problems under risk-sensitivity of the decision-maker.

3 - A Study of Rare Events in Finance
Ionut Florescu, Assistant Professor, Stevens Institute of Technology, Castle Point on The Hudson, Hoboken, NJ, 07030, United States of America, ifloresc@stevens.edu

In this work we investigate financial events where the price shows large changes with relatively small volume. These event are detected in real time and the methodology is compared with two other ways to detect extrema of multivariate distributions: p-efficient points and ziggurat method. We also investigate the relationship between these events and lack of liquidity on the market which is measured using the aggressor indicator available in certain exchange data.

4 - Trailing Stops and Early Liquidation Premium
Hongzhong Zhang, Assistant Professor, Columbia University, New York, NY, 10027, United States of America, hz2244@columbia.edu, Tim Leung

We analyze the optimal timing to liquidate a risky asset subject to a trailing stop order. This leads to an optimal stopping problem with stochastic timing constraint described by a moving barrier. Modeling price dynamics by a time-homogeneous diffusion, we express the optimal timing in terms of the associated drawdown process. We also compare our results to the liquidation problem under a fixed stop-loss barrier.

5 - Trends and Trades
Olympia Hadjiliadis, Associate Professor, Brooklyn College and the Graduate Center, CUNY, 2900 Bedford Ave., Brooklyn, NY, 11209, United States of America, ohadjiliadis@brooklyn.cuny.edu

We build trend following algorithms based on the sequential statistics rules such as the Cumulative sum and the Sequential probability ratio test. We draw the connections between these algorithms and the well-known path dependent statistics used to capture sudden market drops/crashes and upward trends, the maximum drawdown and the maximum draw-ups. In fact the algorithms introduced are trend following algorithms and are seen to be most profitable during times of market instability.

■ MD69

69- Suite 314- Hyatt

New Perspectives on Portfolio Optimization

Cluster: Optimization in Finance

Invited Session

Chair: Daniel Kuhn, Imperial College London, 180 Queen's Gate, London, United Kingdom, d.kuhn@imperial.ac.uk

1 - Efficiency-based Quantitative Asset Selection
Irene Song, Columbia University, Columbia University, 120th Street, New York, NY, 10027, United States of America, is2306@columbia.edu, Soulaymane Kachani, Iraj Kani

In this talk, we propose an efficiency-based asset selection methodology that combines data envelopment analysis (DEA), a non-parametric productivity analysis of relative efficiencies of economic entities, with fundamental analysis in a disciplined manner. We test our strategy in both equity and currency markets and evaluate its performance relative to market benchmarks and widely used regression-based techniques.

2 - Robustifying Convex Risk Measures: A Non-Parametric Approach
David Wozabal, Technische Universitat München, TUM School of Management, Arcisstr. 21, München, 80333, Germany, david.wozabal@tum.de

We robustify convex, version independent risk measures. The robustified measures are defined as the worst case portfolio risk over a neighborhood of a reference distribution. The problem of finding the worst case risk is solved analytically and closed form expressions for the robust risk measures are obtained. Using these results robustified versions for several examples of risk measures are derived and the resulting robust risk measures are tested in rolling-window out-of-sample evaluations.

3 - Hedging Year-End Downside Risk in Global Tactical Asset Allocation
Gerd Infanger, Stanford University, Management Science and Engineering, 475 Via Ortega, Stanford, CA, 94305, United States of America, infanger@stanford.edu

Institutional investors are often concerned with controlling the downside risk at the end of a (fiscal) year as losses incurred at the end of a year determine the risk budget for investments in the following year. We show how dynamic asset allocation can be used to control the downside risk at year-end and analyze the cost and benefits of such management in the context of global tactical asset allocation.

4 - Worst-Case Value-at-Risk of Non-Linear Portfolios
Daniel Kuhn, Imperial College London, 180 Queen's Gate, London, United Kingdom, d.kuhn@imperial.ac.uk, Steve Zymler, Berc Rustem

Most portfolio optimization models involving Value-at-Risk (VaR) assume that the distribution of the risk factors is known exactly. When only partial distributional information is available, however, these models exhibit significant model risk. In this talk we discuss a Worst-Case VaR (WVaR) that is designed to mitigate model risk. We extend WVaR to portfolios that exhibit a polyhedral or quadratic dependence on the risk factors and show how it can be used to structure derivative portfolios.

■ MD70

70- Suite 316- Hyatt

Social Media and Online Opinions

Sponsor: Information Systems

Sponsored Session

Chair: Lu Yan, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, lucyyan@uw.edu

1 - Matching Apps and Ads: An Investigation on Determinant of Ad Click-through Rate on Mobile Devices
Yichun Ho, PhD Student, University of Washington, 4141 Brooklyn Ave., NE, Seattle, WA, 98105, United States of America, chadho@uw.edu, Yong Tan

The work posits to examine how click-through rate of advertisement is affected by the characteristics of applications, developers, users, mobile devices, and advertisement itself. Interesting research questions to be investigated could be: how can we identify optimal matching patterns between apps and ads that can induce higher click-through rate? The data set to be examined is collected from an advertising company targeting in mobile device industry.

2 - Shared Minds: How Patients use Collaborative-Based Information Sharing
Lu Yan, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, lucyyan@uw.edu, Yong Tan

Social media has changed patients' role in managing their health. In this study, we investigate how patients utilize and educate themselves by learning others' shared experiences in the online healthcare communities. The results provide evidence for the existence of social contagion on the Internet for health information seeking and knowledge creation. Implications of these findings in relation to both practitioners and researchers are also discussed.

3 - Rewards and User Behavior in Crowd-based Problem Solving
Mingfeng Lin, University of Arizona, 1130 E. Helen St., Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu, Paulo Goes, Chenhui Guo

We study user behavior in an online knowledge exchange market, in particular, how users respond to certifications schemes designed to encourage participation. Such "meritocracy" arrangements allow users to accumulate points to advance upward in the community hierarchy. We collected an extensive dataset from Experts-Exchange (EE) to examine the effect of user certification on the participation behavior of answerers as well as the choice of askers.

■ MD71

71- Suite 318- Hyatt

eBusiness Models, Business Strategy and Innovation

Sponsor: eBusiness

Sponsored Session

Chair: Harpreet Singh, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, harpreet@utdallas.edu

1 - Impact of Promotions on Location-based Services: Evidence from Foursquare

Lei Wang, PhD Candidate, OPIM Department, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, Lei.Wang@business.uconn.edu, Ram Gopal, Joseph Pancras, Ramesh Sankaranarayanan

Foursquare, top 1 location-based services provider, provides a free platform for businesses to give promotions to customers. We propose a hierarchical linear model to examine the impact of offering promotions though location-based services on the growth rate of consumer traffic. We find (1) If more competitors offer specials through location-based services, the best strategy for a restaurant is to not offer specials; (2) the more competitors a restaurant has, the higher its growth rate will be.

2 - Inventory as a Driver of Demand

Yasin Ceran, University of Texas at Dallas, Richardson, TX, 75080, United States of America, ceran@utdallas.edu

In online retailing, inventory decisions can greatly impact sales for a product by affecting, among other things, availability (stock-outs) and word of mouth (WOM). In this study, we develop a model as an extension of similar structural models introduced in the literature. We investigate the impact of inventory on the amount of lost sales. We use Markov Chain Monte Carlo (MCMC) simulations to test our model with synthetically generated data and then provide an empirical application.

3 - Socio-economic Value of Online User Rating on Box Office Sales

Young Jin Lee, University of Wisconsin at Green Bay, Cofrin School of Business, Green Bay, WI, 54311, United States of America, leey@uwgb.edu

We examine the economic value of prior online user ratings as advertising effect on subsequent box office sales. To correctly identify the value, we use a instrumental variable (IV) estimation strategy with a unique data that includes reviewer and movie level information. Using reviewers' social characteristics in an online social network as IV for online user ratings, we directly compare the effect to weekly advertising spending to quantify the monetary value of online user ratings.

4 - The Online Retailer Fulfillment Service: Why Help Your In-store Competitor?

Wenjing Shen, Assistant Professor, Drexel University, 101 N. 33rd Street, 228A, Philadelphia, PA, 19380, United States of America, ws84@drexel.edu, Gangshu Cai

Online fulfillment program is a service offered to small retailers by large retailers such as Amazon, where large retailers handle shipping and service for the small retailer. We analyze a game between two retailers and find out the conditions under which fulfillment program is beneficial for the large retailer.

■ MD72

72- Suite 322- Hyatt

Computational Stochastic Optimization in Health

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Jennifer Mason, North Carolina State University, 111 Lampe Drive, Campus Box 7906, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu

1 - A Robust Markov Decision Process for Glycemic Control for Patients with Type 2 Diabetes

Yuanhui Zhang, PhD Student, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, yzhang29@ncsu.edu, Brian Denton, Jennifer Mason, Nilay Shah, Steven Smith

We present a Robust Markov Decision Process (MDP) for treatment decisions for glycemic control in patients with Type 2 Diabetes. We describe an approximate dynamic programming (ADP) method to find near optimal policies given uncertainty in transition probability matrix. Performance of the ADP method relative to the non-robust counterpart is discussed. Computational results based on a large clinical dataset are presented to illustrate the structure and influence factors of the optimal policy.

2 - Dynamic Matching via Weighted Myopia with Application to Kidney Exchange

John Dickerson, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, Ariel Procaccia, Tuomas Sandholm

We propose an approach to stochastic optimization that learns potentials of problem elements. Then, we run an offline algorithm at each time period, subtracting from the objective the potentials of the elements used up. Applied to kidney exchange, we analyze the power of potentials on vertices, edges, cycles, and the entire graph. Experimentally, by learning vertex potentials, we get better solution quality than the myopic practice and scale much better than sample-trajectory-based algorithms.

3 - Approximate Dynamic Programming Methods for Optimal Control of Cardiovascular Risk

Jennifer Mason, North Carolina State University, 111 Lampe Drive, Campus Box 7906, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu, Brian Denton, Nilay Shah, Steven Smith

We describe ADP methods to approximate the solution to a finite horizon, non-stationary MDP with a continuous state space defined by risk factors including blood pressure and cholesterol. We compare the performance of policies generated from three ADP methods: state aggregation, basis function approximation of the value function, and a new adaptive state aggregation approach. We present numerical results for the optimal control of blood pressure and cholesterol in patients with type 2 diabetes.

■ MD73

73- Suite 324- Hyatt

Systemic Risk

Cluster: Quantitative Finance

Invited Session

Chair: Konstantinos Spiliopoulos, Assistant Professor, Boston University, Department of Mathematics & Statistics, 111 Cummington Street, Boston, MA, 02215, United States of America, kspiliop@math.bu.edu

1 - Extremely Hard to Borrow (Bankrupt) Stocks

Richard Sowers, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, r-sowers@illinois.edu, Xiao Li, Michael Lipkin

We extend a model of Avellaneda and Lipkin to cover extremely hard-to-borrow (bankrupt) stocks. The only source in stochasticity is Poisson relaxations after short squeezes. We find asymptotic formulae and a risk-neutral model.

2 - Stability and Instability of Interbank-lending System

Tomoyuki Ichiba, University of California, South Hall 5617 A, Santa Barbara, CA, 93106, United States of America, ichiba@pstat.ucsb.edu

We study an interacting diffusion for a competitive interbank lending market where banks extend loans to one another at the interbank short-term rate, in addition to their long-term banking activities. Insufficient transaction in the interbank market triggers multiple defaults and then a financial instability. In our model the lending preferences are linked to the instability of system. We also discuss the role of a financial regulator who enhances the stability of the system under such model.

3 - A Mean-field Model of Systemic Risk and its Large Deviations

Tzu-Wei Yang, Stanford University, 419 Lagunita Dr., Apt. 19, Stanford, CA, 94305, United States of America, twyang@stanford.edu, George Papanicolaou, Josselin Garnier

We model a banking system as an interacting particle system and each component affects the others through their mean field. The system has two stable states that can be interpreted as the normal and failed states. The transition from the system's normal state to the failed state could happen with an exponentially small probability. We use large deviations to compute this small probability and argue that risk sharing may reduce the individual risk but at the same time increase the systemic risk.

4 - Large Portfolio Loss: Conditionally Gaussian Approximations

Justin Sirignano, Stanford University, 3 Gibbs Court, Irvine, CA, United States of America, jasirign@stanford.edu, Kay Giesecke, Konstantinos Spiliopoulos

We extend previous asymptotic results for the loss in a large credit portfolio by proving a first-order correction. This conditionally Gaussian approximation satisfies a stochastic partial differential equation and is shown to offer accurate approximations to the finite portfolio loss distribution. Numerical methods are developed to simulate the approximating loss.

Tuesday, 8:00am - 9:30am

■ TA01

01- West 101- CC

Joint Session Optimization Global/Integer: Piecewise Linear Functions in Global Optimization and Mixed Integer Programming

Sponsor: Optimization/Global Optimization & Optimization/Integer Programming

Sponsored Session

Chair: Juan Pablo Vielma, University of Pittsburgh, 1043 Benedum Hall, 3700 O'Hare Street, Pittsburgh, PA, 15261, United States of America, jvielma@pitt.edu

1 - A Global Optimization Framework for Mixed-Integer Signomial Programs

Christodoulos Floudas, Stephen C. Macaleer '63 Professor in Engineering and Applied Science, Professor of Chemical and Biological Engineering, Princeton University, Department of Chemical & Biological Eng., Princeton, NJ, 08544, United States of America, floudas@princeton.edu, Ruth Misener

Expanding the Global Mixed-Integer Quadratic Optimizer, GloMIQO, we develop a framework for addressing mixed-integer signomial optimization problems to epsilon-global optimality. Our approach reformulates user input, detects special mathematical structure, and globally optimizes the transformed problem. This presentation highlights dynamically generated cutting planes based on convexification strategies including alphaBB, RLT, and specialized underestimators for specific functional forms.

2 - Towards Globally Optimal Solutions for MINLPs by Discretization Techniques

Björn Geißler, Dr., FAU Erlangen-Nürnberg, Cauerstr. 11, Erlangen, 91058, Germany, bjoern.geissler@math.uni-erlangen.de, Alexander Martin, Antonio Morsi, Lars Schewe

We show how to turn any general purpose MIP-solver into a general purpose solver for MINLPs. To this end we construct arbitrary tight MIP-relaxations of the underlying nonlinear problem by extending some well-known MIP-techniques for piecewise linear functions. We present an algorithm which is based on an adaptive refinement of these relaxations and provide numerical evidence for the success of our approach by means of problems from gas network optimization.

3 - Solving Non-linear Optimization Problems using Piecewise Linear Approximation

Vivek Vasudeva, Student, University of Texas at Austin, Department of Information, Risk and Op. Mgmt., 1 University Station, B6000, Austin, TX, 78712, United States of America, vivek.vasudeva@phd.mccombs.utexas.edu, Anant Balakrishnan, Leon Lasdon

This talk discusses a method that combines mixed-integer programming and local search to solve non-linear optimization problems. The approach entails first solving a piecewise linear approximation to the original problem in order to obtain a solution that lies in the basin of attraction of the global solution, and then using this solution as a starting point for a local solver. We discuss variants and enhancements of this approach and report results for selected non-convex non-linear problems.

4 - Incremental Formulations for SOS1 Variables

Sercan Yildiz, Graduate Research Assistant, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, SEY21@pitt.edu, Juan Pablo Vielma

We introduce a hierarchy of formulations for SOS1 variables that incorporates the incremental and logarithmic formulations as its extreme cases. We use these formulations to build MILP models for piecewise linear functions and present computational results that allow us to compare their relative effectiveness.

■ TA02

02- West 102 A- CC

Economics of Sequential Decision Making

Sponsor: Decision Analysis

Sponsored Session

Chair: H. Dharma Kwon, University of Illinois at Urbana-Champaign, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu

1 - Strategic Investment under Spillovers and Information Externalities

Wenxin Xu, University of Illinois, 350 Wohler's Hall, Champaign, IL, 61820, United States of America, wxu9@illinois.edu, H. Dharma Kwon, Anupam Agrawal, Suresh Muthulingam

We study the problem of two firms with investment opportunities when the true economic value of the return is unknown. In particular, we explore the impact of the spillover effects of investment and the information externalities, which arise when the one who invests later can observe the leader's profit stream and learn about the true economic value of the investment opportunities. We find that their impact on the timing of investment is non-trivial.

2 - Learning Consumer Tastes: A Nonparametric Bayesian Model

Canan Ulu, Assistant Professor, University of Texas at Austin, 2110 Speedway Stop B6500, Austin, TX, United States of America, Canan.Ulu@mccombs.utexas.edu, Dorothee Honhon

We develop a nonparametric Bayesian learning model for a firm that can gather information about consumer tastes through sales of its product assortment. The firm can dynamically change its product assortment from period to period to gather better information about consumer tastes. We consider heuristics to solve large problems.

3 - Competitive Control of Market Goodwill and Strategic Exit

Hongzhong Zhang, Assistant Professor, Columbia University, New York, NY, 10027, United States of America, hz2244@columbia.edu, H. Dharma Kwon

We consider the problem of two firms competing for market goodwill, which randomly evolves in time. Each firm can make irreversible investment to increase its goodwill to improve its profit stream and decrease its rival firm's goodwill. They also have an option to exit the market at any point in time. We formulate the problem as a stochastic singular control and stopping game, and we obtain a rich variety of Markov perfect equilibria.

4 - Using Nash Bargaining to Design Project Management Contracts under Cost Uncertainty

Steven Lippman, Professor, University of California-Los Angeles, Anderson School, 110 Westwood Plaza, Suite D517, Los Angeles, CA, 90095-1481, United States of America, steven.lippman@anderson.ucla.edu, Kevin McCardle, Christopher Tang

For procurement contracts in which the cost is uncertain, cost sharing is common. We determine the best cost-sharing contract between a risk-neutral project manager and a risk-averse contractor when negotiation proceeds in accord with Nash bargaining.

■ TA03

03- West 102 B- CC

Joint Session DAS/MAS: Game Theory and Homeland Security I - Screening Models

Sponsor: Decision Analysis & Military Applications

Sponsored Session

Chair: Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - PROTECT: A Deployed Game Theoretic System to Protect the Ports of the United States

Milind Tambe, University of Southern California, Los Angeles, CA, United States of America, tambe@usc.edu, Eric Shieh, Bo An, Rong Yang, Fei Fang, Albert Xin Jiang, Craig Baldwin, Joseph DiRenzo, Ben Maule, Garrett Meyer

PROTECT is a game-theoretic system deployed by the United States Coast Guard in the port of Boston for scheduling their patrols. PROTECT offers several key innovations. First, this system is a departure from the assumption of perfect adversary rationality, relying instead on a quantal response (QR) model of the adversary. Second, We present two new algorithms for computing defender strategies in this QR model. Third, we generate a compact representation of the defender's strategy space.

2 - Multiple-stage Screening Game in the Face of Strategic Applicants

Cen Song, Teaching Assistant, University at Buffalo, 435 Bell Hall, Buffalo, NY, United States of America, censong@buffalo.edu, Jun Zhuang

The security screening system becomes a big concern to identify and deter potential attacks. Based on analyzing the security and congestion in the face of strategic applicants, this paper is further studied in an imperfect and multi-stage screening game. In series queueing network, the error screen probabilities are considered. We provide analytical optimal level of screening strategies for the approver and compare the discriminatory and non-discriminatory screening policies.

3 - Robust Screening Considering the Applicant's Behavior

Jie Xu, University at Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, jxu24@buffalo.edu, Jun Zhuang

The performance of an optimal screening strategy depends critically on how accurately the applicants' behavior has been predicted. In general, players' behavior may be irrational, non-strategic, misinformed or biased. Thus, we use robust optimization to study screening policy with uncertainty about the applicants' strategic ability, utility functions, and constraints, and how sensitive their optimal decisions and expected payoffs are to those uncertainties and the desired level of robustness.

4 - US Visa Applicant Wait Time Analysis

Marie Catalano, Undergraduate Student, University At Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, mjc63@buffalo.edu, Elizabeth Newell, John Coles, Jun Zhuang

The wait time for US Visa applicants to receive a visa varies dramatically often causing excessive and unnecessary wait times. This research analyzes over 5,000 data points and observes the greatest number of people apply in June and December (from 2008-2012). Trends shown by varying visa type, major, month and year in this research also provide insight to the Visa process.

■ TA04

04- West 102 C- CC

Data Envelopment Analysis I

Cluster: Data Envelopment Analysis

Invited Session

Chair: Timo Kuosmanen, Professor, Aalto University School of Economics, PL 21220, Helsinki, Finland, timo.kuosmanen@aalto.fi

1 - Market Demand Analysis by using the Market-data Envelopment Analysis Model, The Case Study: Analysis

Mehdi Ahmadpanah, smapanah@gmail.com, Maryam Ghanizadeh

This paper introduces a market demand analysis model using the Market-Data Envelopment Analysis technique. M-DEA is a new approach that initially uses the AHP technique to extract the main and affecting parameters on different regions' demand and then according to the extracted parameters, it assesses market demand in each region. Among the characteristics of this model is that the effective parameters are considered as a combination to evaluate the market volume of different regions.

2 - Estimating a Nonparametric Non Input Homothetic S-shaped Production Function

Ole Olesen, Professor, University of Southern Denmark, Campusvej 55, Odense M, DK-5230, Denmark, ole@sam.sdu.dk, John Ruggiero

The use of the convex hull estimation in data envelopment analysis (DEA) models is often maintained, although standard microeconomic production theory posits a nonconvex S-shaped production frontier. Recently for an input homothetic production function a nonparametric estimation approach that allows for a nonconvex S-shaped scaling law has been proposed. In this paper we generalize this approach to allow for certain non input homothetic isoquants.

3 - What is the Best Practice for Yardstick Regulation of Electricity Distribution?

Timo Kuosmanen, Professor, Aalto University School of Economics, PL 21220, Helsinki, Finland, timo.kuosmanen@aalto.fi, Antti Saastamoinen, Timo Sipilainen

Electricity distribution is a natural local monopoly. Most regulators apply data envelopment analysis (DEA) or stochastic frontier analysis (SFA) to estimate efficient cost. In Finland, the regulator adopted StoNED method in 2012. This paper compares DEA, SFA and StoNED using data of electricity distribution. While efficiency scores are highly correlated, the cost targets show major differences. StoNED yields superior precision in Monte Carlo simulations.

■ TA05

05- West 103 A- CC

Functional and Profile Data Analysis; Methods and Applications

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kamran Paynabar, University of Michigan, Ann Arbor, MI, United States of America, kamip@umich.edu

1 - A Probabilistic Prediction Framework for Personalized Online Prediction of Epileptic Seizures

Shouyi Wang, University of Washington, 3311 NE 65TH Street, Seattle, WA, 98115, United States of America, shouyi@uw.edu, Art Chaovalitwongse

The talk presents a novel probabilistic framework which integrates and innovates data mining, machine learning and probability theory for online pattern recognition and prediction of target events from nonstationary time series data. With an attractive adaptive learning capability, the proposed probabilistic framework has been demonstrated to be effective to achieve a personalized online seizure prediction for patients with epilepsy.

2 - On using Profile Monitoring Techniques for Monitoring Point Cloud Data

Fadel Megahed, Assistant Professor, Auburn University, 3301L Shelby Center, Auburn, Al, United States of America, fmegahed@vt.edu

3D laser scanners can rapidly provide point clouds consisting of millions of data points, which depict the entire surface geometry of a manufactured part. Consequently, 3D scan data have a great potential to detect unexpected faults. However, SPC methods capable of handling these large data-sets are yet to be developed. In this talk, we show how 3D scanners can be used to significantly improve the monitoring capabilities for manufacturing parts, characterized by complex surface geometries.

3 - Statistical Process Screening System: An Approach For Identifying Irregular Individuals

Peihua Qiu, Professor, University of Minnesota, 224 Church Street SE, 313 Ford Hall, Minneapolis, MN, 55455, United States of America, qiuxx008@umn.edu, Dongdong Xiang

We often need to identify individuals whose longitudinal pattern in certain indices is different from the pattern of those normally working individuals. In many applications, observations of a given individual are obtained sequentially, and it is desirable to have a screening system to give a signal of irregular longitudinal pattern as soon as possible. This paper proposes a method for that purpose.

■ TA06

06- West 103 B- CC

Simulation and Optimization

Contributed Session

Chair: Berna Dengiz, Baskent University, Engineering Faculty Baglica Campus, Eskisehir Road 20th km, Ankara, Turkey, bdengiz@baskent.edu.tr

1 - A Dynamic Network Oligopoly Model with Product Differentiation and Quality Competition

Dong Li, Univerity of Massachusetts-Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, dongl@som.umass.edu, Anna Nagurney

In this paper we develop a dynamic model of oligopolistic competition that includes product differentiation and quality levels in a network framework. We also provide stability analysis results and an algorithm with convergence results, along with numerical examples. This framework can serve as the foundation for the modeling and analysis of competition among firms in industries ranging from food to high tech products.

2 - Analysis of the Effects of Flexibility Factors on Supply Chain Performance

Seratun Jannat, Graduate Student, Mississippi State University, Department of Industrial and System Eng., P.O. Box 9542, Starkville, MS, 39762, United States of America, sj659@msstate.edu, Allen Greenwood

In the design of stochastic flexible supply chains it is important to consider the effects on lead time and cost of such factors as the level of supplier flexibility, efficiency of alternative suppliers, information systems automation, and priority levels. This paper uses discrete-event simulation to assess the impact of these factors and recommend combinations of factor values that positively effect lead time and cost.

3 - Improving the Processing of Clinical Trial Agreements with Simulation and Optimization

Han Wu, Student, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, U of L, Louisville, KY, 40292, United States of America, h0wu0009@louisville.edu, Prajwal Khadgi, Gerald W. Evans, Sunderesh Heragu

The processing of clinical trial agreements (e.g., for the testing of new drugs) at universities is complex, involving the drug company, hospital(s), and university review boards. Reducing the time required for this process is important, since typically there will be competition among various institutions for the agreement with the drug company. This presentation will describe how a simulation model was developed to streamline the process at the University of Louisville.

4 - A TOPSIS- Based Taguchi Approach for Multi Response Simulation Optimization

Berna Dengiz, Baskent University, Engineering Faculty Baglica Campus, Eskisehir Road 20th km, Ankara, Turkey, bdengiz@baskent.edu.tr, Yusuf Tansel Ic

In this study, a multi-response simulation optimization problem related the flexible manufacturing system (FMS) is solved using the TOPSIS based Taguchi method. In the solution procedure, this method reduces the multi-response optimization problem to a single-objective decision-making problem, because Taguchi method is not able to handle this kind of simulation optimization problems only by itself. The hybrid simulation optimization method is applied to a real problem.

■ TA07

07- West 104 A- CC

Joint Session DM/QSR: Bayesian Inference and Computational Issues

Sponsor: Data Mining & Quality, Statistics and Reliability

Sponsored Session

Chair: Tevfik Aktekin, Assistant Professor of Decision Sciences, University of New Hampshire, 15 Academic Way, Durham, NH, 03824, United States of America, Tevfik.Aktekin@unh.edu

1 - Tuberculosis and HIV Mortality, Modelling of Multivariate ZIP Distribution with Time Series

Rasim Musal, Assistant Professor, Texas State University, 1611 West Fifth Street, Austin, TX, 78703, United States of America, rm84@txstate.edu, Tevfik Aktekin

We investigate the effect of poverty and inequality on HIV and Tuberculosis mortality in the 62 counties of NY with spatial effects. We quantify inequality with the Theil Index and poverty via the ratios of the two Census variables in each ZCTA. As with HIV, Tuberculosis is a rare cause of mortality and many of the counties have 0 counts. This provides the motivation for a joint zero inflated Poisson distribution Bayesian model with time.

2 - Applications of Bayesian Methods in Healthcare Fraud Detection

Tahir Ekin, PhD Candidate, The George Washington University Department of Decision Sciences, 2201 G St Funger Hall 415 NW, Washington, DC, 20052, United States of America, ekin@gwu.edu, Toros Caglar, Refik Soyer

Some applications of Bayesian ideas in healthcare fraud detection will be presented. The emphasis will be on the use of Bayesian co-clustering and link analysis methodologies to identify billing patterns of potentially fraudulent providers who submit a large number of high-dollar claims submitted to healthcare insurance programs for reimbursement. Alternative Bayesian frameworks for modelling sample-based audits of healthcare related payments and overpayment situations will also be discussed.

3 - Dynamic Bayes Network Approach to Market Basket Analysis

Bumsoo Kim, PhD Candidate, George Washington University, 2201 G Street NW, Funger Hall #415H, Washington, DC, 20052, United States of America, bk4498@gwu.edu, Srinivas Prasad, Refik Soyer

In this paper we consider utilizing DBN's to model different market basket problems. The proposed approach can be used for learning and inference objectives, for both model parameters of a given structure and the dynamics of the structure itself. We use MCMC methods and use results from the DBN literature to devise learning algorithms in a time-series market basket data setting. We illustrate the implementation of proposed approach with low-dimensional problems and discuss their applications.

4 - Bayesian Parametric and Semi-parametric Modeling of Call Center Abandonment

Tevfik Aktekin, Assistant Professor of Decision Sciences, University of New Hampshire, 15 Academic Way, Durham, NH, 03824, United States of America, Tevfik.Aktekin@unh.edu, Refik Soyer

We consider the modeling and inference of abandonment behavior in call centers. We present different family of distributions, piecewise time to abandonment, mixtures and semi-parametric models, develop Bayesian inference for posterior and predictive analyses with censored abandonment and discuss implications on staffing. We use real call center data, present additional insights that can be obtained from the Bayesian analysis and discuss implications for different customer profiles.

■ TA08

08- West 104 B- CC

Emergency Medical Services

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Laura McLay, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

1 - Next Generation Emergency Location Tools: Heuristics with Simulation

Hari Rajagopalan, Associate Professor, Francis Marion University, P.O. Box 100547, Florence, SC, 29502, United States of America, HRajagopalan@fmarion.edu, Cem Saydam, Elizabeth Sharer, Muhammad Zaffar

Location models for emergency response systems have rapidly evolved from the initial mathematical models which required many simplifying assumptions to make the models tractable. In this paper, we discuss the use of simulation with meta-heurstic search methods in location models to bring more realism and generate a richer output to get a better insight on the effectiveness of location models.

2 - EMS Planning and Management

Armann Ingolfsson, University of Alberta, School of Business, Edmonton, AB, T6G2R6, Canada, armann.ingolfsson@ualberta.ca

I survey research on planning and management for Emergency Medical Services, including: Forecasting demand, forecasting response times, measuring performance, choosing base locations, allocating ambulances to bases, based on predictable and unpredictable changes in demand and travel times. I focus on empirical work, the use of analytical stochastic models, and ways in which medical researchers and operations researchers could benefit from collaboration.

3 - Joint Location and Dispatching Decisions for Emergency Medical Services

Hector Toro-Diaz, Clemson University, 204 Freeman Hall, Clemson, SC, 29634, United States of America, htoro@clemson.edu, Maria Mayorga, Sunarin Chanta, Laura McLay

Reducing ambulance response time saves lives. We propose a joint location and dispatching model aimed to minimize the Mean System Response Time (MRT), and a solution procedure based on Genetic Algorithms (GA). The commonly used fixed a-priori dispatching rule sending the closest ambulance has shown to be effective in minimizing the MRT across a variety of different system's characteristics.

4 - Predictive Performance of Data Mining and Regression Methodologies on 911 Call Counts

Laura McLay, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave., Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Richard Garrett

In this presentation, we compare data-mining and regression models for forecasting emergency medical and fire 911 call counts. A novel aspect of this project is the inclusion of weather variables in the data set. The data mining techniques include Support Vector Machines (SVM) using the Gaussian kernel and Random Forests (RF). The data mining techniques are compared to negative binomial regression. The predictive performance of all models is assessed via 10-fold cross-validation.

■ TA09

09- West 105 A- CC

Advances in Multiobjective Programming

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Margaret Wiecek, Professor, Clemson University, Martin Hall O-208, Clemson, SC, 29634, United States of America, wmalgor@clemson.edu

1 - Block Coordinate Descent-type Decomposition in Multiobjective Programming

Brian Dandurand, Clemson University, O-110 Martin Hall, Box 340975, Clemson, SC, 29631, United States of America, bdandur@clemson.edu, Margaret Wiecek

Decomposition of multiobjective programs (MOPs) in the objective space, the decision space, and simultaneously both spaces according to the principles of block coordinate descent is investigated. Coordination algorithms and conditions for their convergence to the Pareto set of the original MOP are developed. Computational examples are given.

2 - Robust Multiobjective Optimization: Theory and Methodology

Erin Doolittle, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States of America, edoolit@clemson.edu, Margaret Wiecek, Hervé Kerivin

For an uncertain multiobjective optimization problem (MOP) we develop conditions for the feasibility of a related robust counterpart. We show that MOPs with uncertainty in the objective functions or the right-hand side of the constraints are equivalent to MOPs with uncertainty in the constraint coefficients. For data uncertainty represented as ellipsoidal sets, we transform the uncertain MOP into a tractable and deterministic MOP, keeping the same Pareto solution set.

3 - Multiplicative Epsilon-Dominance in Multiobjective Programming

Lakmali Weerasena, PhD Student, Clemson University, O-110, Martin Hall, Box 340975, Clemson, SC, 29634, United States of America, lweeras@clemson.edu, Margaret Wiecek

Multiplicative epsilon-dominance is studied as a binary relation that yields the epsilon-Pareto set being an approximation of the Pareto set for multiobjective programs (MOPs). The effect of generalizing the Pareto cone to polyhedral or more general convex cones in order to obtain approximations of nondominated sets of MOPs is examined.

4 - Advancing Branch-and-bound Techniques for Mixed-integer Multiobjective Programming

Margaret Wiecek, Professor, Clemson University, Martin Hall O-208, Clemson, SC, 29634, United States of America, wmalgor@clemson.edu, Pietro Belotti, Banu Soylu

Properties of the Pareto set for mixed integer linear multiobjective programs (MOPs) are studied. Branch-and-bound (BB) rules for pure integer MOPs are reviewed and examined against their applicability for mixed integer MOPs. More effective components of a BB algorithm, namely a fathoming procedure and a data structure for Pareto solutions, especially tailored to mixed integer MOPs, are proposed and integrated into a BB algorithm.

■ TA10

10- West 105 B- CC

Stochastic Financial Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Miguel Lejeune, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

1 - Library of Test Financial Optimization Problems at the University of Florida

Stan Uryasev, American Optimal Decisions, 5214 SW 91 Way, Ste. #130, Gainesville, FL, 32608, United States of America, uryasev@aorda.com

Presentation will describe the library of stochastic financial optimization problems posted at the University of Florida at this link: www.ise.ufl.edu/uryasev/research/testproblems/financial_engineering/ The library includes problem statements, data, and solutions in Portfolio Safeguard format.

2 - Percentile Optimization in Portfolio Management

Aurelie Thiele, Associate Professor, Lehigh University, aurelie.thiele@lehigh.edu, Elcin Cetinkaya

We investigate portfolio management problems where the decision-maker seeks to maximize a left-tail percentile of the return distribution. We discuss data-driven techniques to incorporate the percentile in a tractable formulation and present insights into the resulting strategy, both from a theoretical standpoint and in numerical experiments.

3 - Risk-Averse Enhanced Indexation

Miguel Lejeune, George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu, Gulay Samatli-Pac

We propose a partial replication strategy to construct risk-averse enhanced index funds. The variance of the index fund return must be below a low-risk threshold with a large probability, thereby limiting the market risk exposure. We derive a deterministic equivalent for the quadratic risk constraint and develop an exact outer approximation method. The method provides a hierarchical organization of the computations with expanding sets of integer-restricted variables and scales well.

■ TA11

11- West 105 C- CC

First-Order Methods for Large-scale Convex Optimization and Their Applications

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Fatma Kilinc-Karzan, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, fkilinc@andrew.cmu.edu

1 - On Unified View of Nullspace-type Conditions for Sparse and Low-rank Recoveries

Fatma Kilinc-Karzan, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, fkilinc@andrew.cmu.edu, Arkadi Nemirovski, Anatoli Juditsky

We present general framework to handle sparsity structures and associated recoveries of signals from their linear image of reduced dimension possibly corrupted with noise. This unified treatment includes sparse and block-sparse recoveries as well as low-rank matrix reconstruction. We present sufficient conditions for the recovery to be precise in the noiseless case, derive error bounds for imperfect recovery under these conditions and present efficiently verifiable sufficient conditions.

2 - Accelerating Level Methods for Large-scale Convex Optimization

Guanghui Lan, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, congdd@ufl.edu, Cong Dang

We introduce accelerated level methods optimal for large-scale convex programming problems and smoothing level methods optimal for a class of structured saddle point problems. Promising numerical results for solving certain Semidefinite programming and imaging problems will be presented.

3 - Accelerated Proximal-Gradient Homotopy Method for the Sparse Least-Squares Problem

Qihang Lin, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qihangl@andrew.cmu.edu, Lin Xiao

We solve L1-regularized least-squares (L1LS) problem by approximately solving a sequence of L1LS with decreasing regularization parameters. Each L1LS is solved by accelerated gradient method and the returned solution is used to warm start the next L1LS. Under suitable assumptions, this method ensures that all iterates are sparse so that it obtains a global geometric convergence rate due to the strongly convexity of the objective function restricted on the sparse subspace.

■ TA12

12- West 106 A- CC

Theory and Application of Mixed Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Kiavash Kianfar, Assistant Professor, Texas A&M University, TAMU 3131, College Station, TX, 77843-3131, United States of America, kianfar@tamu.edu

1 - Network Design with Stochastic Arc Capacities

Avinash Bhardwaj, University of California Berkeley, 450/60 Sutardja Dai Hall, University of California Berkeley, Berkeley, CA, 94720-1764, United States of America, avinash.bhardwaj@berkeley.edu, Alper Atamturk

We present models and branch-and-cut algorithms to find a min cost fixed charge network with stochastic arc capacities. We derive strong valid inequalities for the convex hull of the solutions. We provide inequality extension and lifting algorithms to obtain the facets of the convex hull.

2 - An Integrated Approach for the Fleet Assignment, Aircraft Routing, and Crew Pairing Problem

Shengzhi Shao, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, szshao@vt.edu, Hanif D. Sherali, Mohamed Haouari

We propose a novel formulation that integrates fleet assignment, aircraft routing, and crew pairing within a single mixed-integer linear program, and derive valid inequalities to further tighten the representation. A Benders decomposition-based solution approach is adopted together with several acceleration strategies. Computational results are presented using real-life data obtained from a major U.S. airline to demonstrate the efficacy of our approach and to provide insights.

3 - Polyhedral Studies for Vendor-Managed Inventory Models

Ayse Nur Arslan, PhD Student, University of Florida, Department of Industrial and Systems, Engineering 303 Weil Hall, Gainesville, FL, 32608, United States of America, nur.arslan@gmail.com, Jean-Philippe Richard, Yongpei Guan

We study a family of vendor-managed inventory models. We first present a polynomial time dynamic programming algorithm and the corresponding extended formulation. In addition, we perform a polyhedral study of the corresponding set. We obtain several families of facet-defining inequalities which provide the convex hull description for two periods.

4 - Continuing Work on Lifting Nonlinear Nonconvex Formulations

Daniel Bienstock, Columbia University, Department of IEOR, New York, NY, United States of America, dano@columbia.edu

We describe continuing work on efficient cutting-plane procedures for addressing nonconvex feasible regions. Some computational results may be provided.

■ TA13

13- West 106 B- CC

Applications of Convex Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Miguel F. Anjos, Canada Research Chair in Discrete Nonlinear Optimization in Engineering, Ecole Polytechnique de Montreal, C.P. 6079, succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, miguel-f.anjos@polymtl.ca

1 - QPCCs, QCQPs, and Copositive Programming

John Mitchell, Professor, Rensselaer Polytechnic Institute, Math Sciences, Troy, NY, 12180, United States of America, mitchj@rpi.edu, Jong-Shi Pang, Lijie Bai

We show that members of a certain class of quadratically constrained quadratic programs (QCQPs) can be represented as quadratic programs with complementarity constraints (QPCCs). We exploit this relationship to show that the Frank-Wolfe theorem holds for the members of this class of QCQPs, namely that they attain their optimal value if it exists. We also show that a completely positive relaxation of certain QPCCs is tight, even if the complementary variables in the QPCC are unbounded.

2 - Robust Low-rank Tensor Recovery via Convex Optimization

Zhiwei Qin, Columbia University, Room 313, 500 W. 120th St., New York, NY, 10027, United States of America, zq2107@columbia.edu, Donald Goldfarb

Recovering low-rank tensors from gross corruptions and missing values is important for multilinear data analysis. We study the problem of robust low-rank tensor recovery in a convex optimization framework, and we propose efficient algorithms based on the alternating direction method of multipliers and the accelerated proximal gradient method. The practical effectiveness of the model and the algorithms is demonstrated through a series of synthetic and real examples.

3 - A Branch and Cut Algorithm for Solving Capacitated Max K-Cut with an Application in Scheduling

Matthew Oster, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, osterm38@eden.rutgers.edu, Jonathan Eckstein

We model the scheduling of a symmetric multi-track conference as a capacitated version of Maximum K-Cut (MKC). We solve this NP-hard problem to optimality within a branch-and-bound framework equipped with a semidefinite programming relaxation of MKC, enhanced with triangle and clique cuts, as well as problem-specific cuts (e.g. capacity cuts). We introduce a heuristic for generating feasible solutions at most tree nodes. Test results will be discussed for serial and parallel implementations.

4 - A Semidefinite Optimization Approach to Space-free Multi-row Facility Layout

Miguel F. Anjos, Canada Research Chair in Discrete Nonlinear Optimization in Engineering, Ecole Polytechnique de Montreal, C.P. 6079, succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, miguel-f.anjos@polymtl.ca, Philipp Hungerlander

Multi-row facility layout seeks an optimal placement of departments along rows. Large single-row problems have been solved to global optimality using semidefinite optimization. We extend the approach to space-free multi-row layout and show that if provides high-quality bounds in reasonable time.

■ TA14

14- West 106 C- CC

Planning and Scheduling Models for Manufacturing and Service Systems

Cluster: Scheduling and Project Management

Invited Session

Chair: Chelliah Sriskandarajah, University of Texas at Dallas, 800 W. Campbell Rd. Sm30, Richardson, 75080, United States of America, chelliah@utdallas.edu

1 - Project Management under Environmental Regulation

Gokce Esenduran, Ohio State University, College of Business, 656 Fisher Hall Fisher, Columbus, OH, 43210, United States of America, esenduran_1@fisher.osu.edu, Nicholas Hall, Zhixin Liu

We investigate the implications of environmental regulations on project scheduling. We model the decisions of a regulator and multiple project managers (PMs) as a Stackelberg game. The regulator specifies pollution remediation requirements, and the PMs respond either by remediation or by investment in greener task design. Our results show that the decisions of the regulator and PMs are not initially coordinated. However, the regulator can coordinate them by providing a subsidy to the PMs.

2 - A Special Hybrid Flowhsop Scheduling Problem with No Buffer

Esaignani Selvarajah, Assistant Professor, University of Windsor, 401 Sunset Avenue, Windsor, On, Canada, selvare@uwindsor.ca

We study job sequencing in a special hybrid flowshop when there is no buffer. The problem is NP-hard. Therefore, we first study the two stage hybrid flowshop problem. Then we provide a mathematical model and a heuristic algorithm for the multi-stage m-machine problem.

3 - A New Heuristic for Scheduling Strictly Periodic Services in Discrete Time Intervals

Osman Kazan, Teaching Assitant, Jindal School of Management, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, oxk031000@utdallas.edu, Milind Dawande, Chelliah Sriskandarajah, Kathryn Stecke

Operational practices of a national recycling and waste management company inspired us to formulate a combinatorial optimization problem. The challenge was to schedule strictly periodic services with a perfectly balanced total weekly workload. We analyzed the complexity and established heuristic techniques for well-balanced schedules with worst-case guarantees. The effectiveness of these techniques are confirmed by computational results on real-life and artificial data.

4 - Value of Information in a Three-Player Environment
Manoj Vanajakumari, Texas A&M University, 3367 TAMU, Collge Station, TX, 77843, United States of America, manojuv@neo.tamu.edu, Subodha Kumar

In this research we study a supply chain system in which a manufacturer has two suppliers — a low cost supplier (S1) and a high cost supplier (S2). S1 has a dedicated capacity for the manufacturer; however, S2 allocates capacity for the manufacturer based on a forecast provided. In a given period, the manufacturer has to optimize the fraction of the demand allocated to S2 while S2 has to find the capacity allocated for the manufacturer. In such a setting we study the value of information.

■ TA15

15- West 202- CC

Software Demonstration

Invited Session

1 - AnyLogic Simulation Software-Examples and Customer Case Studies
George Gonzalez-Rivas, National Director, AnyLogic, 53 Frontage Rd., Ste. 115, Hampton NJ 08827, United States of America, grivas@anylogic.com, Andrei Borshchev

Customer case studies and examples of AnyLogic. AnyLogic simulation software is compatible with Windows, MAC and Linux, allows you to build powerful simulation models and has 3D animation capabilities. AnyLogic works with three paradigms of modeling: system dynamics, agent based modeling and discrete event modeling.

2 - JMP Software from SAS - Visual
Mia Stephens, JMP Software from SAS, 100 SAS Campus Dr., Cary NC 27513, United States of America, mia.stephens@jmp.com

JMP Statistical Discovery Software is interactive and visual desktop software for Windows and Mac, with a complete array of integrated graphical and statistical procedures. We will demonstrate JMP tools for data analysis, visualization and exploration, including, Graph Builder®, bubble plots, the data filter, and our popular mapping tools.

■ TA16

16- West 207- CC

Combinatorial Auctions

Cluster: Tutorials

Invited Session

Chair: Subramanian Raghavan, Professor, University of Maryland, Robert H. Smith School of Business, 4365 Van Munching Hall, College Park, MD, 20742, United States of America, raghavan@umd.edu

1 - Combinatorial Auctions
Subramanian Raghavan, Professor, University of Maryland, Robert H. Smith School of Business, 4365 Van Munching Hall, College Park, MD, 20742, United States of America, raghavan@umd.edu

This tutorial provides an introduction to combinatorial auctions. Topics discussed will include bidding languages (how bidders can bid), solution methods (how do you decide who wins what), and pricing (how much do the winners pay). Some recent innovations in auction formats and pricing will be discussed including the Day-Raghavan procedure (also referred to as a core-selecting auction) which has been used in several government auctions to date. No familiarity with the area is assumed.

■ TA17

17- West 208 B- CC

Joint Session: INFORM-ED/SPRIG: Spreadsheet Modeling: Past and Future?

Sponsor: INFORM-ED & Spreadsheet Productivity Research Interest Group

Sponsored Session

Chair: Tom Groleau, Chair, Social Science Division, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States of America, tgroleau@carthage.edu

1 - Creating VisiCalc: The First Spreadsheet
Daniel Fylstra, President, Frontline Systems Inc., P.O. Box 4288, Incline Village, NV, 89450, United States of America, daniel@solver.com

This talk will recount the creation of the first spreadsheet program, VisiCalc, on the Apple II in 1979, including its development and marketing. At the time, experts believed that the need for financial planning and modeling software was fully served by several large competitors, with powerful systems offered through time-sharing. But the author and his colleagues saw the world differently. We now know that the experts were wrong 33 years ago - but what does that mean for today?

2 - Spreadsheet Shifting Sands: Is There an App for That?
Tom Groleau, Chair, Social Science Division, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States of America, tgroleau@carthage.edu

VisiCalc revolutionized end-user computing and created a generation of spreadsheet-native college students. As Excel took over the spreadsheet world, the OR/MS community used it as a bridge to bring modeling to the masses. However, the landscape may be changing. Does "spreadsheet" still equal "Excel"? As app-native students join the work world, will spreadsheets continue to be the dominant end-user modeling tool?

3 - What Do New Graduates Need to Know?
Rick Carter, CEO, Equation Consulting, 2650 S Decker Lake Blvd., Salt Lake City, UT, United States of America, rcarter@equationconsulting.com

Equation Consulting does spreadsheet based analysis for healthcare providers all over the world. Their employees need to be both fast and accurate in their work. We will demonstrate the spreadsheet skills test that we administer in our hiring process.

4 - Spreadsheets Are Fine, But ...
Paul Rubin, Professor Emeritus, Michigan State University, 1312 Ramblewood Drive, East Lansing, MI, 48823, United States of America, rubin@msu.edu

Spreadsheets play a significant role in operations research. They can be useful as data sources, for testing results, and for communicating those results to customers. Some analyses can be done entirely in spreadsheets, but often they are simply not the best tool for building and solving (and in some cases explaining) models. We will discuss pros and cons of using spreadsheets as a modeling platform.

■ TA18

18- West 208 A- CC

Optimization Software in the Wild: Experiences From Code Trenches

Sponsor: Optimization/Computational Optimization and Software

Sponsored Session

Chair: Cem Vardar, Senior Optimization Scientist, Revionics Inc., 8700 East Via de Ventura, Suite 280, Scottsdale, AZ, 85258, United States of America, cvardar@revionics.com

1 - Using Unit and Integration Tests for Developing High Quality Optimization Software
Cem Vardar, Senior Optimization Scientist, Revionics Inc., 8700 East Via de Ventura, Suite 280, Scottsdale, AZ, 85258, United States of America, cvardar@revionics.com

Automated unit and integration testing of software is a widely used practice in Software Engineering for ensuring high quality in code development. In this talk we are going to show some examples of how automated unit and integration testing is being used at Revionics in development of highly utilized operations research software. We'll show examples of automated tests from an inventory allocation problem and a demand forecast modeling algorithm used in a price optimization setting.

2 - Column Generation in Practice: Efficiency Gains through Use of Concurrency and Lessons Learned
Bertan Altuntas, Operations Research Software Developer, LeanLogistics Inc., 1351 S Waverly Rd, Holland, MI, 49423, United States of America, bertan.altuntas@leanlogistics.com

Column generation is a well-known technique used to solve large scale linear programming problems. At LeanLogistics, we have implemented a column generation based vehicle routing problem solver within our On-Demand Transportation Management System. In this talk, I would like to focus on some practical aspects of implementing a column generation based solver, how we utilized parallel processing to improve efficiency of the solver and most importantly the lessons learned along the way.

3 - "Cloud Manufacturing"– Distributed Caching on the Semiconductor Manufacturing Floor

Patrick N Bless, Dr., Intel Corp., 5000 W. Chandler Blvd. Chandler, CH5-255, Phoenix, AZ, 85048, United States of America, pbless@gmail.com

Semiconductor manufacturing equipment relies on large amounts of complex input data including recipes, test programs, and lot information. This data needs to be routed in real-time to process equipment on the floor to avoid idle time/utilization loss. Instead of isolating the equipment from each other via a centralized database system the author has developed a distributed, peer-aware in-memory data store designed to optimize data delivery rates while providing virtually unlimited scalability.

4 - Grid Computing in the Software as a Service (SaaS) Environment

Jeff Moore, Revionics Inc., 8700 East Via de Ventura, Suite 280, Scottsdale, AZ, 85258, United States of America, jmoore@revionics.com, Craig Morris

Retail planning applications such as pricing, promotions, and markdown optimization require weekly, daily, and on-demand processing to leverage the most up-to-date data and to enable retailers to realize greatest benefits. SaaS Grid Computing shares resources among many retailers and provides much more efficient use of hardware. We will discuss lessons learned in building, running and maintaining a grid environment for optimization applications in a federated, multi-customer SaaS environment.

■ TA19

19- West 211 A- CC

Workforce Considerations in Health Care

Contributed Session

Chair: Su Xie, Stanford Graduate School of Business, 655 Knight Way, Stanford, CA, 94306, United States of America, xiesu@stanford.edu

1 - Combining Staffing with Quick-Response Decisions to Improve Hospital Performance

Jan Schoenfelder, Doctoral Candidate, Indiana University, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, janschoe@indiana.edu, Daniel Wright, Edwin Coe, Kurt Bretthauer

We present a model that combines initial nurse staffing level decisions with two classes of quick-response decisions: (1) adjustments to the number of nurses in each unit, and (2) transfers of patients between units. Both improve hospital performance by anticipating or responding to day-to-day fluctuations in patient demand.

2 - A Comprehensive Bayesian Framework for Patient Aligned Care Team (PACT) Work Load Estimation

Sara Shirinkam, Wayne state university, Wayne State University, Detroit, MI, United States of America, sshirinkam@gmail.com, Kai Yang, Adel Alaeddini

Patient Aligned Care Team (PACT) consists of a group of healthcare professionals with different expertise such as physician and nurse practitioner to provide accessible, comprehensive, and patient-centered care. We develop a comprehensive framework based on discrete cluster weighted modeling and Bayesian inference to provide accurate, reliable and real-time estimate of PACT workload estimation. Using a real dataset from a medical center we demonstrate the performance of the proposed framework.

3 - WholeSurgeon Performance: Multiattribute Performance Appraisals to Support Personnel Decisions

Robert Dees, University of Texas at Austin/US Army/Mayo Clinic, 18905 Colonial Manor Lane, Pflugerville, TX, 78660, United States of America, rob.dees@gmail.com, Donald Potter, John Osborn, Stephanie Heller

WholeSurgeon is a multiattribute model developed at the Mayo Clinic to measure the performance of surgeons. With this model, we are better able to communicate vision, mentor in line with our values, measure the talent of individuals, and support personnel decisions. In addition, WholeSurgeon provides a sound response variable for predictive recruiting models. We discuss elicitation from multiple experts, implementation, relationship to psychometrics, predictive techniques, and initial results.

4 - Networks, Diversity and Stability: Cardiac Surgery Team Structure and Performance

Emmanouil Avgerinos, PhD Candidate, University College London, Department of Management Science and, Innovation, Gower Street, London, WC1E 6BT, United Kingdom, emmanouil.avgerinos.10@ucl.ac.uk, Bilal Gokpinar

The relationship between team structure and performance constitutes a matter of debate in the literature. In this study, we examine the relationship between network structure, team diversity and stability and their impact on efficiency and effectiveness of cardiac surgery operations. Using a large scale operational data from more than six thousand cardiac surgeries between 2005 and 2012, we highlight the significance of team structure on productivity and performance.

5 - Forecasting and Dynamic Adjustments of Staffing Level in Hospital Operating Rooms

Su Xie, Stanford Graduate School of Business, 655 Knight Way, Stanford, CA, 94306, United States of America, xiesu@stanford.edu, Polly He, Stefanos Zenios

The staffing level in hospital operating rooms(time block of operating rooms assigned to a specialty) is decided biannually. We propose a model that hospital has the opportunity to forecast and adjust the staffing level dynamically as information of demand is updated over time. The optimal policy is proved to be state-dependent. Using the data from a teaching hospital, we are able to show that demand forecasts evolves as MMFE and conduct numerical experiment to study the value of adjustments.

■ TA20

20- West 211 B- CC

Issues In Public Health

Contributed Session

Chair: Serena Faruque, PhD Candidate, Stanford University, 330 Serra Mall, Stanford, CA, 94305, United States of America, serenaf@stanford.edu

1 - Calibrating Epidemiological Parameters of Influenza Simulation Models in Short Decision Cycles

Diana Prieto, Assistant Professor, Western Michigan University, Industrial Engineering, 1903 W. Michigan Ave., Kalamazoo, MI, 49008-5336, United States of America, diana.prieto@wmich.edu, Tapas Das

Influenza outbreak simulations are not yet adapted for operational response in progressing pandemic outbreaks. One of the features in need for operational adaptation is the model calibration. Usually, simulation models require human interaction to adjust the internal model parameters until obtaining a desired value. In this research, we propose a viral count driven approach to automate the calibration process and eliminate the need of the human component.

2 - Arrival Processes Based on SIR Models for Epidemic Diseases

Baykal Hafizoglu, Arizona State University, 699 S Mill Avenue, Tempe, AZ, 85281, United States of America, baykal@asu.edu, Maria Rieders, Esma Gel, Lerzan Ormeci

Susceptible-Infected-Recovered models are commonly used to analyze the spread of epidemic, pandemic and infectious diseases. In this paper, we shed some light on the arrival process of patients at a hospital due to an epidemic. We modify a Markovian SIR model by assuming that infected patients seek help at a hospital at an exponential rate. We present a recursive formulation for the calculation of the Laplace transforms for the interarrival times for the sequence of patients seeking help.

3 - Evaluation of the Functional Result and Quality of Life after Orthopedic Surgery

Chi-Chang Chang, Assistant Professor, Chung-Shan Medical University Hospital, 110, Sec. 1, Chien-Kuo N. Rd., Taichung, Taiwan-ROC, changintw@gmail.com, Chen-Wen Chang

This research was to investigate the extent of psychological symptoms that individuals experience following orthopedic trauma and whether associated with quality of life. We adopted the SCL-90R scale and SF-36 to conducted Regression Analyses and Structural Equation Modeling to predict the quality of life among study patients. The results showed psychological symptoms ultimately affect the quality of life.

4 - Optimization of Interventions for Reduction of Maternal Mortality and Morbidity

Serena Faruque, PhD Candidate, Stanford University, 330 Serra Mall, Stanford, CA, 94305, United States of America, serenaf@stanford.edu, Jeremy Goldhaber-Fiebert, Aparna Hegde

Approximately 350,000 women die yearly from complications of pregnancy or childbirth. WHO estimates that more than half of those deaths are preventable. Providing preventative information - through people, or technology such as mobile phones - reduces maternal mortality and morbidity. We model how information improves patient adherence and health outcomes. Given a budget, mathematical optimization yields a package of technological and human intervention to maximize patient and societal outcomes.

5 - Modeling Hepatitis C Medications and Treatment Strategies

Marshall Kuypers, Sandia National Labs, 1515 Eubank SE, Albuquerque, NM, United States of America, mkuyper@sandia.gov, Thomas Moore

A large cohort of patients infected with the Hepatitis C virus is progressing through the Veterans Hospital. New medications and treatment strategies have recently become available but there are many questions remaining regarding the optimal treatment. We present a system dynamics model that analyzes multiple facets of Hepatitis C disease treatment.

■ TA21

21- West 212 A- CC

CVaR and Chance Constrained Optimization in Networks

Sponsor: Optimization/Networks

Sponsored Session

Chair: Baski Balasundaram, Assistant Professor, Oklahoma State University, Industrial Engineering and Management, 322 Engineering North, Stillwater, OK, 74074, United States of America, baski@okstate.edu

1 - Detecting Robust Cliques in Graphs with Uncertain Edge Failures

Oleksandra Yezerska, PhD Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, yaleksa@tamu.edu, Sergiy Butenko, Vladimir Boginski

We present an exact algorithm for detecting robust cliques in graphs subject to uncertain edge failures. As clique can be alternatively defined based on its various properties, the edge failure may yield different types of losses. We will discuss two loss functions (the sum and the max of vertex degree violations) and show that utilizing each of them ensures with certain probability the solution (after edge failures) will be s-defective clique or s-plex, respectively.

2 - Detecting r-robust 2-clubs in Graphs under Probabilistic Edge Failures

Esmaeel Moradi, Oklahoma state University, 322 Engineering North, Industrial Engineering & Management, Stillwater, OK, 74075, United States of America, esmaeel.moradi@okstate.edu, Foad Mahdavi Pajouh, Baski Balasundaram

A subgraph of diameter at most k is called a k-club, a relaxation of cliques for k larger than 1. Extending this definition by requiring at least r distinct paths of length at most k, between all pairs of nodes results in the r-robust k-club model. This talk will present preliminary results on a conditional value-at-risk (CVaR) based model to detect large r-robust 2-clubs in random graphs with probabilistic edge failures.

3 - On Chance-constrained Minimum Spanning K-core Problem under Probabilistic Edge Failure

Juan Ma, Research Assistant, Oklahoma State University, 92S University Place, Apt 6, Stillwater, OK, 74075, United States of America, Juan.Ma@okstate.edu, Baski Balasundaram

Spanning k-cores can be used to design survivable networks that preserve low diameter conditions upon vertex deletion. This talk will focus on a chance-constrained model of the minimum spanning k-core problem under probabilistic edge failures. We explored a branch-and-cut decomposition framework recently introduced in the literature, and this talk discusses problem specific enhancements via cutting-planes, scenario reduction approaches, and present preliminary numerical results.

■ TA22

22- West 212 B- CC

40 Years of Forrest and Tomlin

Sponsor: Computing Society

Sponsored Session

Chair: John Tomlin, FICO, 181 Metro Plaza, San Jose, CA, United States of America, j_a_tomlin@yahoo.com

1 - 40 Years of Forrest and Tomlin

John Forrest, Faster Coin, 19 Wix's Lane, London, SW4 0AL, United Kingdom, john.forrest@fastercoin.com, John Tomlin

We review the the impact of the updating of triangular factors, and in particular our F-T method, on the speed of the simplex method, both at the time of publication 40 years ago, and in the years since on many mathematical programming (optimization) systems.

2 - A Review of Sparsity vs Stability in LU Updates

Michael Saunders, Stanford University, 475 Via Ortega, Stanford, CA, United States of America, saunders@stanford.edu

The Forrest-Tomlin update has stood the test of time within many generations of commercial mathematical programming systems. Its ease of implementation leads to high efficiency and evidently acceptable reliability. We review its relation to Reid's version of the Bartels-Golub update as implemented in LA05, LA15, and LUSOL. In particular, we examine the extent to which FT implementations must "live dangerously" in order to achieve the desired efficiency.

3 - Modern Implementation of the F-T method

Richard Laundy, FICO Xpress Development, United Kingdom, richardlaundy@fico.com

Although the original F-T method was designed to work efficiently with limited memory, out-of-core versions of the simplex method, it has proved suitable for modern in-core implementations. We outline some of these implementation details.

■ TA23

23- West 212 C- CC

Innovation in Analytics Award: Semi-finalist Presentations I

Sponsor: Analytics

Sponsored Session

Chair: Michael Gorman, University of Dayton, Dayton, OH, United States of America, michael.gorman@udayton.edu

1 - Robust Routing for Battery Electric Vehicles

Daniel Reich, Operations Research Analyst, Ford Motor Company, 2101 Village Road, MD 2122, Dearborn, MI, 48124, United States of America, dreich8@ford.com, Mark Jennings, Mary Smith, Michele Plattenberger, Dimitris Bertsimas, Thomas Magnanti, Perry MacNeille, Ryan McGee, Ciro Soto, Joe Rork, Bill Frykman, Susan Curry, Erica Klampfl, Matthew Fontana, Oleg Gusikhin

Battery electric vehicles (BEV) present many new challenges. Among them are limited driving range, long charging time, and highly variable energy consumption patterns. New vehicle electronics features are needed to help drivers make sound decisions: ones that avoid discharged battery situations and extend vehicle range. We are developing an innovative solution that combines traffic simulation, propulsion modeling, and optimization to provide BEV drivers with the best routes for their trips, based on time, travel preferences and energy consumption. By doing so, we aim to improve public confidence in vehicle electrification and achieve the social objectives obtainable through this emerging technology

2 - BracketOdds: Examining the NCAA Men's Basketball Tournament with Advanced Analytics

Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue (MC258), Urbana, IL, 61801, United States of America, shj@illinois.edu, Douglas King, Adrian J. Lee, Alexander Nikolaev

The NCAA Men's Basketball Championship draws considerable popular attention every March, often termed "March Madness". Before this tournament begins, sports fans and neophytes attempt to predict a "perfect bracket" that correctly forecasts the winners of all tournament games, and submit their predictions to competitions (e.g., office pools, Internet-wide competitions). This research uses advanced analytics to assess the probability that a combination of seeds will advance in the tournament based on historical tournament results. Beginning in 2011, this model was adapted into a web-based tool, allowing users to assess prospective brackets online and leading to significant popular and media attention.

3 - Machine Learning for Power Grid Reliability: Predicting Manhole Events in New York

Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Steve Ierome, Delfina Isaac, Rebecca Passonneau, Axinia Radeva

I will present innovations in proactive power grid maintenance stemming from a collaboration between Columbia University and Con Edison, NYC's power utility company. Specifically, I will describe the Manhole Events Project, where the goal is to predict electrical failures, including manhole fires and explosions in New York City. I will discuss the data mining process by which we transformed extremely raw historical data into a ranking model that predicts manhole vulnerability. Our ranked lists are currently assisting with the prioritization of future inspections and repairs in Manhattan, Brooklyn, and the Bronx.

■ TA24

24- West 213 A- CC

Disease Monitoring and Optimal Screening and Treatment Policies

Sponsor: Health Applications Society

Sponsored Session

Chair: Alireza Sabouri, University of British Columbia, Vancouver, BC, Canada, alireza.sabouri@sauder.ubc.ca

1 - Optimal Hypertension Management for Risk-averse Patients with Scarce Resources

Gregg Schell, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, schellg@umich.edu, Mariel Lavieri, Jeremy Sussman, Rodney Hayward

We develop a Markov decision process formulation to determine optimal hypertension treatment regimens for a risk-averse patient with scarce resources who seeks to minimize the expected number of coronary heart disease events over the planning horizon. Initial results from the model illustrate the diminishing returns of increased planning horizon resources. We also investigate the effect of risk-aversion, initial pretreatment blood pressure, and initial coronary heart disease risk.

2 - Evaluation of Breast Cancer Mammography Screening Policies Considering Adherence Behavior

Mahboubeh Madadi, University of Arkansas, 4207 Bell Engineering Center 1, Fayetteville, AR, 72701, United States of America, mmadadi@uark.edu, Shengfan Zhang

The efficacy of mammography screening guidelines is highly associated with women's compliance with these recommendations. However, none of the existing policies take women's adherence behavior into consideration. Instead, perfect adherence is often assumed. In this study, a partially observable Markov model is proposed to evaluate and compare various screening policies, while incorporating variation in women's adherence behavior.

3 - Personalized and Adaptive Diabetes Management: A Robust Optimization Approach

Allison O'Hair, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, akohair@mit.edu, Dimitris Bertsimas

We propose an optimization approach to manage the blood glucose levels of type II diabetes patients by optimizing food and exercise choices. We use robust integer optimization in a dynamic and adaptive way to determine food preferences and mixed-integer optimization to select an optimal meal and exercise plan that minimizes individual blood glucose levels. We have implemented an online software using the proposed approach and report evidence of its strength.

4 - Optimal Screening Strategies of Patients on the Kidney Transplant Waiting List

Alireza Sabouri, University of British Columbia, Vancouver, BC, Canada, alireza.sabouri@sauder.ubc.ca, Steven Shechter, Tim Huh

The health condition of patients on the kidney transplant waiting list deteriorates while they are waiting for an organ arrival and hence they may no longer be suitable for transplant. Therefore, transplant centers screen waiting patients at various intervals to identify ineligible patients. We propose a model for finding screening strategies that minimizes the probability of offering a transplant to ineligible patients.

■ TA25

25- West 213 B- CC

Organ Transplantation Modeling

Sponsor: Health Applications Society

Sponsored Session

Chair: Ashley Davis, PhD Candidate, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, AshleyDavis2012@u.northwestern.edu

1 - An Empirical Analysis of the Effects of Kidney Allocation Policies on Patient Behavior

William Williford, Graduate Student, Kellogg School of Management, 2169 Campus Drive, Evanston, IL, 60208, United States of America, w-williford@kellogg.northwestern.edu, Baris Ata, Che-Lin Su, Guenter Hitsch

We develop an optimal stopping model for patients on the deceased donor kidney wait list presented with kidney offers. Data provided by the United Network for Organ Sharing (UNOS) is then used to estimate the model's parameters via maximum likelihood estimation. The model is subsequently applied to several alternative kidney allocation policies in order to analyze their effects on the distribution of kidneys.

2 - Challenges in Training Cardio Thoracic Transplant Surgeons

Amy Cohn, University of Michigan, Ann Arbor, MI, United States of America, amycohn@umich.edu, Rishindra Reddy, Mark Daskin

Surgical residents training to become heart-lung transplant surgeons must perform a sufficient number of transplants during their residency/fellowship to become certified. There is an inherent conflict between the time required to do so (along with the underlying stochasticity of transplant arrivals and durations)versus the regulations that limit trainees' work hours. We quantify this conflict and propose alternative approaches.

3 - Random Effects ANOVA for Testing Heterogeneity of Brownian Motion Cancer Growth

Gordon Hazen, Professor, Northwestern University, IEMS Department, McCormick School of Enginering, Evanston, IL, 60208, United States of America, gbh305@northwestern.edu, Neehar Parikh, Talia Baker, Daniel Apley

There is no consensus on the optimal treatment of liver cancer when transplant is an option. Deterministic growth models based on ODEs are unsuitable for decision analytic modeling where future growth is uncertain and growth is heterogeneous. Instead, we fit geometric Brownian motion to natural history data for liver cancer, and adapt variance component models to test heterogeneity across data sources and patients. The fitted model allows for adaptive choice of treatment based on growth history.

4 - Improving Utilization and Outcomes of High Kidney Donor Profile Index Kidney Transplants

Ashley Davis, PhD Candidate, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, AshleyDavis2012@u.northwestern.edu, Sanjay Mehrotra, Daniela Ladner, John Friedewald, Anton Skaro, Jane Holl, Michael Abecassis

High Kidney Donor Profile Index kidneys (hKDPI) are most frequently discarded because of allocation system inefficiencies. We analyze current hKDPI kidney allocation and model three alternative allocation systems to compare each system's expected allocation efficiency by mean kidney travel distance. We find that optimized directed Donor Service Area allocation reduces kidney travel distance by 42%. This reduction may potentially reduce hKDPI kidney wastage in a time of great organ shortage.

■ TA26

26- North 221 A- CC

Healthcare Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Rodney Parker, Associate Professor, University of Chicago, Booth School of Business, 5807 South Woodlawn Ave, Chicago, IL, 60637, United States of America, rodney.parker@chicagobooth.edu

1 - Geographical Factors Deriving Deceased Donor Kidney Procurement Rates

Mazhar Arikan, University of Kansas, School of Business, Lawrence, KS, United States of America, mazhar@ku.edu, Rodney Parker, Baris Ata

The deceased donor allocation system exists because of the severe shortage of available organs. Contrary to much of the current literature, we investigate the supply side. By using the donor registry data we show that the organ procurement rates vary significantly across different geographic areas and that the procurement rates are significantly correlated with the wait times. We build a structural model and conduct counterfactual analyses to understand the ways of increasing supply of organs.

2 - Physician Behavior and Patients' Access to Healthcare with Payer Mix

Tingting Jiang, Student, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, tingting-jiang@northwestern.edu

Across the U.S., Medicaid patients' access to healthcare is diminishing. Low reimbursement rate compared with private health plan is usually blamed for physicians' reluctance to accept Medicaid patients. We use a game theoretical model to study the physician's capacity allocation and investment decisions as the competition for healthcare service intensifies. We find that physicians may prefer to provide service to patients with low and high reimbursement rates together due to scaled economy.

3 - On Hospice Operations under Medicare Reimbursement Policies

Rodney Parker, Associate Professor, University of Chicago, Booth School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, rodney.parker@chicagobooth.edu, Bradley Killaly, Tava Olsen, Baris Ata

The Medicare's hospice reimbursement policy consists of a daily payment for each patient under care with a global cap of revenues during the Medicare year, which increases for each newly admitted patient. We demonstrate several unintended consequences of the current reimbursement structure analytically. We also examine if the current policy is responsible for a recent spate of hospice bankruptcies. We propose an alternative policy, which overcomes the existing policy's shortcomings

■ TA27

27- North 221 B- CC

New Business Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Karan Girotra, INSEAD, Boulevard de Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu

1 - Resources for Results: Reducing the Funding Gap for Social Development Projects

Milind Sohoni, Indian School of Business, Gachibowli, Hyderabad, 500032, India, milind_sohoni@isb.edu, Sripad Devalkar

We study a market-based funding approach for social ventures wherein a not-for-profit intermediary solicits resources from donors for perfectly verifiable results post implementation. We analyze if such an approach reduces the gap between supply and demand of funds for social ventures. We answer the following questions: (i) Does an intermediary enhance welfare?, (ii) Is such a strategy sustainable and scalable?, and (iii) What is the impact of the intermediary's operational costs?

2 - The Use (and Abuse) of Customer Voting Systems

Simone Marinesi, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, simone.marinesi@insead.edu, Karan Girotra

This study examines a novel business process where firms conduct online polls asking customers to vote in favor of new product designs, and then uses the voting outcome to takes development and/or pricing decisions. Typically, customers are incentivized to vote by offering them purchase discount for the products they vote for. Our analysis highlights several pitfalls in the design of Customer Voting Systems, and we provide prescription on how such systems should be employed.

3 - The Benefits of Decentralized Decision Making in Supply Chains

Elena Belavina, Assistant Professor, Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, elena.belavina@chicagobooth.edu, Karan Girotra

The inefficiency of decentralized decision making is one of the most influential findings of the supply chain coordination literature. We show that with the possibility of repeated trade, decentralization can be beneficial in improving supply chain performance. With decentralized decision making, it is easier to incentivize players to coordinate on efficient actions. It is manifested both in higher supply chain profits and more flexibility in contracting terms that are acceptable to all players.

4 - The Impact of Workforce Management Software Introduction upon Performance

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Tom Tan

We analyze the impact of introducing workforce management software which induces competition among restaurant servers. We show that the tournament can be an effective tool in incentivizing workers.

■ TA28

28- North 221 C- CC

Empirical Healthcare Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Diwas KC, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, Diwas_Kc@bus.emory.edu

1 - Revisiting the NH Needle Exchange Program: A Sensitivity Test for Seviations from Uniform Sampling

Donald Lee, Yale University, 135 Prospect St., New Haven, CT, donald.lee@yale.edu

Program evaluation relies critically on the quality of and methodology for outcome measurement. However, it is often difficult to obtain information on outcomes for the entire population, or even a representative sample. We introduce a sensitivity test for deviations from equal probability sampling of units, and use it to test the robustness of the reported outcomes in the New Haven needle exchange program. Joint work with Peter Aronow (Yale Political Science).

2 - Patient Revisit Interval in Primary Care: Impact on Patient Health and Panel Size

Hessam Bavafa, Doctoral Candidate, The Wharton School, UPenn, 3730 Walnut St., Hunstman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, bavafa@wharton.upenn.edu, Christian Terwiesch, Sergei Savin

We study the decision made by primary care physicians regarding patient revisit interval (RVI). We provide insights on the impact of RVI on panel size, emergency visits and patient health. We also evaluate the value of remote patient monitoring with which the physician receives informative signals from the patient such as blood pressure, weight, etc. between patient visits. We show that utilizing these signals can help the physician increase his panel size and quality of care.

3 - Efficiency Analysis of Hospitals

Sriram Venkatraman, Doctoral Student, Clemson University, 100 Sirrine Hall, Clemson, SC, 29634-130, United States of America, svenkat@clemson.edu, James Sun, Maria Ibanez, Aleda Roth, Anita Tucker

This paper estimates efficiencies of hospitals in the U.S., using input and output measures from publically available data sources. We introduce a consistent bootstrap technique from data envelopment analysis literature to compare hospitals on various bases and draw meaningful statistical inference. We also test the assumption of returns to scale.

4 - Does the Individual Mandate Free You To Choose

Diwas KC, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, Diwas_Kc@bus.emory.edu, Sriram Venkataraman

We study a natural policy experiment - the Massachusetts healthcare reform law - to examine the impact of universal healthcare on patient volume and the allocation of volume of previously uninsured patients across different emergency departments. Our model of patient choice finds that post-policy, utility maximizing patients choose to avoid safety-net hospitals.

■ TA29

29- North 222 A- CC

Scheduling and Capacity Management in Hospitals

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Nan Liu, Columbia University, 600 W 168th St., Room 603, New York, NY, 10032, United States of America, nl2320@columbia.edu

1 - Procedure Room Allocation Decisions with Demand Uncertainty
Bjorn Berg, George Mason University, 4400 University Drive, MS 4A6, Fairfax, VA, 22030, United States of America, bberg2@gmu.edu, Brian Denton

Urgent add-on procedures make planning and scheduling decisions difficult in outpatient procedure center settings. The decisions of dynamically allocating procedures to procedure rooms are modeled as a stochastic online bin-packing problem. A special case is formulated as multi-stage stochastic integer program. Results for optimal capacity management decisions are presented as well as results for easy-to-implement heuristics.

2 - On Quantifying the Benefits of Coordinating OR Capacity Management
Fei Li, University of Minnesota, 111 Church Street S. E., Minneapolis, MN, 55455, United States of America, lixxx768@umn.edu, Diwakar Gupta

Patient Protection and Affordable Care Act is intended to align health care providers' and suppliers' incentives to provide patients the right care at the right time. Payment mechanisms will reward providers for better health outcomes, rather than for the volume of services provided. We develop models to quantify the benefits that may accrue from more efficient use of OR capacity when hospital and physician incentives are aligned. These models are tested on sample data from a community hospital.

3 - Multi-resource Allocation Scheduling of Elective and Emergency Surgery in Dynamic Environments
Van-Anh Truong, Columbia University, vt2196@columbia.edu, Tim Huh, Nan Liu

We formulate the first model of allocation scheduling for emergency and elective surgeries in a dynamic environment, where distributional information about demand and resource availability is continually updated and scheduling decisions exploit new information as it arises. We allow multiple resources to be considered, and patients to renege.

4 - Capacity Planning for Cancer Prevention
Aaron Ratcliffe, Aaron_Ratcliffe@kenan-flagler.unc.edu, Ann Marucheck, Wendell Gilland

We develop a queuing network to optimize providers' capacity and pricing decisions for consumers seeking repeat service. Consumers' repeat arrival behavior is a function of guideline compliance and the expected value, price, and wait-time for service. Utilizing public health data for colorectal cancer screening, we inform government planning and intervention.

■ TA30

30- North 222 B- CC

Risk Management in Agricultural Markets

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Onur Boyabatli, Singapore Management University, 50 Stamford Road, Singapore, Singapore, oboyabatli@smu.edu.sg

1 - Yield Management in Agricultural Markets
Kwan Eng Wee, Assistant Professor, Singapore Management Univesity, 50 Stamford Road #04-01, Singapore, 178899, Singapore, kewee@smu.edu.sg, Onur Boyabatli

This paper considers a processor who has to decide on the sourcing options for an agricultural input in the face of farm yield uncertainty of that input. The input can be sourced from farmers on a long-term contract basis in advance, or through an open market on the day. The processors can also use different pricing schemes on the output side to hedge against the yield uncertainty. Our work studies the impacts of these options on the processor's operations and performance.

2 - Agricultural Planning of Annual Plants under Demand, Maturation, Harvest, and Yield Risk
Baris Tan, Professor of Operations Management, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, 34450, Turkey, btan@ku.edu.tr

We present a planning methodology for a firm whose objective is to match the random supply of annual premium fruits and vegetables from a number of contracted farms and the random demand from the retailers during the planning period. The proposed method determines the farm areas and the seeding times in such a way that the expected total profit is maximized. The profit obtained by this method is substantially higher compared to the planning approaches where the uncertainties are not considered.

3 - Dynamic Risk Management of Commodity Operations
Sripad Devalkar, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sripad_devalkar@isb.edu, Ravi Anupindi, Amitabh Sinha

We model the dynamic risk management problem for a commodity processor in a multi-period setting. We use a time-consistent risk measure based on the conditional value at risk (CVaR) and obtain the optimal operational and financial hedging policy in a partially complete market. We quantify the value of time-consistent decision making in terms of mean-risk tradeoff. We also quantify the value of excess procurement and processing capacities as operational hedging levers.

4 - A Dynamic Mechanism for Achieving Sustainable Quality Supply
Fang Liu, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798, Singapore, liu_fang@ntu.edu.sg, Jing-Sheng Song, Tracy Lewis

Various companies have realized the importance of sustainable quality supply and initiated sustainability guidelines. However, are these guidelines sufficient to ensure sustainable quality supply? We design a dynamic mechanism that implements sustainable quality supply. Part of our mechanism suggests a two-part nonlinear tariff payment which is consistent with the existing industry guidelines; whereas the other part suggests new elements such as the probabilistic decision rights.

■ TA31

31- North 222 C- CC

Pricing and Services

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu

1 - Markdown Management: Pricing as a Signaling Device
Gad Allon, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo, Ramandeep Randhawa

We study the classical revenue management scenario of a monopolist retailer selling to customers over a finite horizon. The retailer possesses information about the aggregate demand, whereas customers have private information on their valuations and are strategic. We study how the profit maximizing retailer strategically uses price as a signaling device.

2 - Pricing and Operational Performance in Discretionary Services
Raj Rajagopalan, University of Southern California, Marshall School of Business, Los Angeles CA, United States of America Srajagop@marshall.usc.edu, Chunyang Tong

In discretionary services, the value or quality derived by a customer from a service depends upon the time the service provider (SP) devotes to the customer and the valuation differs across customers. We identify the optimal pricing scheme and explore the impact of two widely used pricing schemes, time-based billing and fixed fee, on many dimensions of service performance including SP's profitability, demand, utilization, and congestion level.

3 - Selling to the Censored Newsvendor: Optimal Wholesale Price with Demand Learning
Yunru Han, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, yhan14@gsb.columbia.edu., Fangruo Chen

One classic result concludes that the censored newsvendor sets a higher inventory level for demand learning instead of optimizing one-period profit. Yet if the supplier can change the wholesale price, she may either exploit or collaborate on the retailer's learning policy, depending on the contracting and information sharing process. We study the supplier's optimal wholesale price in various situations, and compare the profitability and efficiency of active learning and myopic policies under it.

4 - Queue Joining Strategies when Expected Service Time and Value are Unknown
Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu, Senthil Veeraraghavan

When the expected service time and service value are not perfectly known to a consumer base, but, positively correlated, both posterior value and waiting cost increase in the queue length. We show that this leads to non-monotone queue joining strategies.

■ TA32

32- North 223- CC

Economics of Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Manu Goyal, David Eccles School of Business, University of Utah, Salt Lake City, United States of America, Manu.Goyal@business.utah.edu

1 - Stage-Gate Contracts for New Product Development

Chunlin Wang, David Eccles School of Business, University of Utah, Salt Lake City, chunlin.wang@business.utah.edu, Krishnan Anand, Glen Schmidt

We gain new insights into why a firm might use a stage-gate contract when outsourcing New Product Development. The contract helps address both adverse-selection and moral hazard issues. We study the optimal number and placement of gates, and compare the performance of stage-gate contracts with traditional outsourcing contracts.

2 - Contracting for On-Time Delivery in the US Influenza Vaccine Supply Chain

Soo-Haeng Cho, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, soohaeng@andrew.cmu.edu, Tinglong Dai, Fuqiang Zhang

Motivated by the flu vaccine industry, we consider a supply chain that involves three sources of uncertainties: design, delivery, and demand. In such a supply chain it is critical for the firms to choose the right production quantity at the right time. It is shown that several well-known contracts fail to coordinate the supply chain. So we propose new coordinating contracts that are reported in practice but not studied in the extant literature.

3 - Pricing and Rationing When Selling to Snobbish Consumers

Kenan Arifoglu, Assistant Professor, University College London, Gower Street, London, WC1E 6BT, United Kingdom, k-arifoglu@northwestern.edu, Seyed Iravani, Sarang Deo

We study the pricing policy and capacity decision of a firm selling snob-appeal products such as high-fashion luxury goods to forward-looking, exclusivity-seeking (snobbish) consumers. We use our model to explain the heterogeneity in pricing of snob-appeal products; some firms adopt uniform pricing while others mark down. We also find cases, where firms create scarcity and mark the price down simultaneously during the selling season.

4 - Honesty as an Optimal Policy under Bounded Rationality

He Chen, R.H. Smith School of Business, University of Maryland, College Park, United States of America, hechen@rhsmith.umd.edu, Manu Goyal, Krishnan Anand

Incomplete contracts are vulnerable to opportunism. In a multi-period relationship with incomplete contracts between a boundedly-rational manufacturer and his supplier, we prove that an 'honest' manufacturer can outperform a quintessential 'opportunistic' manufacturer, even though the opportunistic manufacturer can mimic the honest manufacturer. Thus, honesty emerges endogenously as an optimal policy.

■ TA33

33- North 224 A- CC

Inventory Review Policies

Contributed Session

Chair: Raik Özsen, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, raik.oezsen@uni-koeln.de

1 - A New Approach to Inventory Management

Rasoul Haji, Professor, Sharif University of Technology, Azadi Ave., Tehran, Iran, haji@sharif.edu

We introduce a new approach to inventory management called No Review Inventory Management (NORIM) which is simple, easy to apply, and eliminates the suppliers' demand uncertainty and safety stock. For a special case we obtain the optimal total cost rate and compare it with the (s, S) policy optimal solution.

2 - Generalized EOQ Model with Two Levels of Warehouse Storage

Maxim Bushuev, PhD Candidate, Kent State University, 540 S Water St., #311, Kent, OH, 44240, United States of America, mbushuev@kent.edu

A continuous review (Q, R) model with backorder is extended to a model with two levels of storage (owned and rented warehouses) and alternative cost dimensions such as ([$/unit/unit time], [$/unit time], and [$/unit]). Optimal conditions are derived and the convexity is discussed.

3 - Ranking the Quality of Lead Time Demand Models

Yasin Unlu, Research Scientist, LLamasoft, Inc., 3404 Columbus Lane, Ann Arbor, MI, 48103, United States of America, yunlu@uark.edu, Manuel D. Rossetti

This paper discusses a number of different measures to rank the quality of given LTD models for the classic continuous review (r, Q) inventory system. Two types of measures are used: 1) test measures; namely, chi-square, Kolmogorov-Smirnov and sum of squared error that are estimated based on utilizing the observed LTD values during simulation, 2) error measures that are estimated based on a number of inventory performance measures.

4 - A Generalized Basestock Inventory Policy

Abhilasha Aswal, International Institute of Information Technology Bangalore, 26/C Electronics City, Bangalore, India, abhilasha.aswal@iiitb.ac.in, G N Srinivasa Prasanna

We present a generalization of the basestock policies for multi-item inventory optimization. Co-related inventory constraints can form arbitrary polytopes and may have many faces. We can have a generalized basestock policy, with an outer re-order polytope and an inner trigger polytope. In contrast to a standard (s,S) policy, here the threshold and reorder point of each product keep changing, as a function of available inventory of the other products.

5 - An Optimal Expediting Policy for Periodic-review Inventory Systems

Raik Özsen, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, raik.oezsen@uni-koeln.de, Ulrich Thonemann

Most inventory models assume that lead times are exogenously given. However, in many situations inventory managers have the option to expedite open orders. We incorporate the expediting option into a periodic review inventory model and solve the model optimally. Unlike previous research, we evaluate the objective function exactly and show how the optimal solution can be computed efficiently. We estimate the benefit of order expediting based on real data from a global equipment manufacturer.

■ TA34

34- North 224 B- CC

Experimental Research on Innovation/NPD

Cluster: New Product Development

Invited Session

Chair: Jeremy Hutchison-Krupat, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, KrupatJ@darden.virginia.edu

1 - Leaps in Innovation

Joel Wooten, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States of America, jwooten@wharton.upenn.edu

Experiments have the ability to test theory and validate hypotheses. Here, we look at algorithmic innovation tournaments from Kaggle.com to examine the effect of incremental progress in innovation. We use submission-level entries in data-driven tournaments to examine whether the innovation horizon inspires additional innovation.

2 - Ambiguous Problem Complexity, Group Synergy and Performance: An Experiment

Elliot Bendoly, Associate Professor, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, elliot_bendoly@bus.emory.edu, Stylianos Kavadias, Svenja Sommer

Kavadias and Sommer (2009) describe a normative model predicting strong collaborative group problem solving in relatively simple settings, but weakness in increasingly complex ones. We revisit the issue through a computer-based experiment. The value of the normative model is strengthened through the consideration of member diversity, focus, control and accountability.

3 - Tolerance for Failure and Incentives for Collaborative Innovation

Jeremy Hutchison-Krupat, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, KrupatJ@darden.virginia.edu, Raul Chao

An organization's ability to innovate can be enhanced by managing risk-taking behavior through monetary incentive schemes and through an organizational culture that tolerates failure. This paper reports the results of two controlled experiments aimed at understanding how tolerance for failure and incentives impact the decisions of individuals engaged in a collaborative innovation initiative.

■ TA35

35- North 225 A- CC

Behavioral Strategies

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: John Wilson, Ivey School of Business, Univ. of Western Ontario, London, Canada, jwilson@ivey.uwo.ca

1 - New Results Concerning Probability Distributions with Increasing Generalized Faiure Rates

Prakash Mirchandani, University of Pittsburgh, Katz Graduate School of Business, Pittsburgh, PA, 15260, United States of America, pmirchan@katz.pitt.edu, Mihai Banciu

The generalized failure rate (GFR) of a random variable is an extension of its hazard rate. If the valuation distribution of a product has an (strictly) increasing GFR, then the associated revenue function is unimodal, and its global maximum is (uniquely) specified. This talk proposes an alternate economic viewpoint that extends the commonly accepted definition of the GFR and presents some new properties related to the closure of IGFR distributions under different operations.

2 - Competing with Customer Returns Policies

Jing Chen, Associate Professor, Faculty of Business & Economics, University of Winnipeg, 460 Portage Avenue, Winnipeg R3B 2E9 CANADA, Winnipeg, MB, R3B 2E9, Canada, je.chen@uwinnipeg.ca, Bintong Chen

Customer returns policies vary in the retailing industry. We develop a model to illustrate how retailers with different customer returns policies compete for customers via pricing. We further extend the model to demonstrate how customer returns policy can be used as a competing strategy to acquire customers and its associated impact on pricing and market segmentation.

3 - Behavioral Bidding Strategies

Fredrik Odegaard, Assistant Professor, Richard Ivey School of Business, 1151 Richmond St. N, London, On, N6G4X3, Canada, fodegaard@ivey.uwo.ca

Auctions and bidding strategies have a rich and extensive research history. While theoretical results regarding optimal bidding strategies are well-established, there are also numerous empirical anomalies. In this paper we investigate certain simple bidding heuristics and compare those with observed online bidding behavior.

4 - A Behavioral Perspective of Strategic Interactions in Revenue Management Markets

Srinivas Krishnamoorthy, University of Western Ontario, 1151 Richmond Street N, Room 2R14A, London, ON, N6A 3K7, Canada, skrishnamoorthy@ivey.uwo.ca

Aggregate pricing decisions of travel capacity providers often appear to be economically irrational. A typical example is a price war between competing airlines or the special deals offered by competing hotels. Standard game theoretic models fail to explain these decisions. We use behavioral game theory to obtain more realistic predictions of provider behavior in competitive revenue management markets.

5 - Block T Discounts on the Internet

John Wilson, Ivey School of Business, Univ. of Western Ontario, London, Canada, jwilson@ivey.uwo.ca, Jing Chen

Many of the new internet discount outlets have some form of a promotion involving T items offered at a discount price. Selling at a discount would cannibalise from the retailers current customers since they could buy at the cheaper price. However, it would take customers from the retailer's competitors. For a wide class of distributions, we derive necessary and sufficient conditions for a promotion to be optimal.

■ TA36

36- North 225 B- CC

Topics in Pricing and Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: N. Bora Keskin, University of Chicago, Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu

1 - Pricing Managed Lanes

Caner Gocmen, Columbia Business School, 3022 Broadway, Uris Hall, 4V, New York, NY, 10027, United States of America, fgocmen13@gsb.columbia.edu, Robert Phillips

A managed lane is loosely defined as a separated highway lane operated with active flow management. The entity responsible from operating the lane manages the flow to the lane by levying tolls or setting regulations. Managed lanes with tolls are becoming an important way to finance new public works. We investigate the optimal operating policies for managed lanes with tolls by taking the viewpoint of the operating entity which may seek to maximize the revenue or the social surplus.

2 - Dynamic Matching with Heterogeneous Goods

Hua Zheng, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, hzheng14@gsb.columbia.edu, Ciamac Moallemi, Costis Maglaras

We study a dynamic market for heterogenous goods: buyers and sellers arrive dynamically over time; sellers supply heterogenous units to the market; buyers are endowed with a choice model to select among heterogeneous alternatives; participants have idiosyncratic valuations and incur delay costs while waiting to trade. We study the equilibrium of such a market, and characterize its "depth" of active sellers and buyers as well as price dispersion. A motivating application is residential real-estate.

3 - Bounded Rationality in Strategic Interactions in Supply Chain

Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@MIT.EDU, Basak Kalkanci

Despite the standard assumption of perfect rationality in theoretical models, decision makers are often boundedly rational and are subject to errors and biases, particularly in interactions with other decision makers. We examine how bounded rationality drives the interaction of multiple players in supply chain to find out (1) how much is lost by assuming perfect rationality and (2) whether bounded rationality can work as an advantage for a decision maker.

4 - Dynamic Pricing with Demand Learning in a Changing Environment

N. Bora Keskin, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, bora.keskin@chicagobooth.edu, J. Michael Harrison, Assaf Zeevi

We consider a dynamic pricing problem in which a seller faces an unknown demand model that can change over time. We evaluate several pricing policies via simulation, and provide simple guidelines to implement price experimentation while keeping track of changing market conditions.

■ TA37

37- North 226 A- CC

Network Interdiction and Defense Modeling

Sponsor: Location Analysis

Sponsored Session

Chair: Mark Daskin, Professor, University of Michigan, Department of IOE, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu

1 - An "All Hazards" View of Supply Chain Resilience

David Alderson, Operations Research Department, Naval Postgraduate School, Monterey, CA, United States of America, dlalders@nps.edu, Marco Laumanns

We model tactical planning in a supply chain that must mitigate and balance protection against both "worst-case" disruptions, as might be caused by the deliberate actions of an intelligent adversary, and "most likely" disruptions as caused by non-deliberate hazards, such as natural disasters or technological failures.

2 - A Heuristic Model for Highway Interdiction
Tolga Seyhan, Operations Research Scientist, Amazon.com, 345 Boren Ave. N, Seattle, WA, 98109, United States of America, tolgaseyhan@gmail.com, Lawrence V. Snyder

We consider a network interdiction model in which a smuggler uses a network of roads and an interdictor deploys patrol units to increase the smuggler's cost of using particular roads. We heuristically reformulate the smuggler's problem, which is a prize-collecting Steiner tree problem, and solve the interdictor's problem as a single-level mixed-integer program.

3 - Defender-interdictor Location Models with Uncertain Futures
Kaiyue Zheng, IOE Department, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, zkaiyue@umich.edu, Mark Daskin

We model scenario-based two-stage p-robust defender-interdictor problems. The defender allocates resources to mitigate the interdictor's actions, while the interdictor wants to maximize damage while inflicting at least a minimal level of damage in each scenario. We present two models with different interdictor options. Algorithms and computational results are given.

■ TA38

38- North 226 B- CC

Supply Chain Services: Models and Applications – I

Sponsor: Service Science

Sponsored Session

Chair: M. Ali Ulku, Assistant Professor, School of Management and Leadership, Capital University, 1 College and Main, Columbus, OH, 43209, United States of America, aulku@capital.edu

1 - Impact of Inventory Control Policies on On-time Delivery in a Divergent Supply Chain
Joon Young Lee, Graduate Student, ASU ME, 850 S. McAllister Ave. ISTB2 275, Tempe, AZ, 85287, United States of America, jylee4@asu.edu, Seung Hwan Kim

Assignment and placement policies (rationing and soft-pegging) are considered when a customer order is materialized at a diversification point in a divergent supply chain in order to maximize customer service level. A semiconductor wafer fab is modeled. We experiment with various input scenarios to see the effects of our policies. We show that on-time delivery is maximized in equilibrium state at lot bank by proper assignment policies, and lot bank is selected as a good location.

2 - Integrated vs. Dedicated: Delivery System Choice for a Vertically Differentiated Product Line
Aditya Jain, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, aditya_Jain@isb.edu, Ram Bala

We analyze service systems choice – integrated or dedicated, for supporting services, which are provided along with vertically differentiated products. We characterize the preferred choice as a function of performance deterioration that may result from mix variability. We show the impact of market cannibalization on strategic operations decision.Further, this impact of cannibalization varies depending on the market scale as well as market mix.

3 - Simulation Study of a Three-level CPFR System
James Bookbinder, Professor, University of Waterloo, 200 University Ave. West, CPH 4323, Waterloo, ON, N2L 3G1, Canada, jbookbinder@uwaterloo.ca, Amanda Cha

Sales data on several product groups of a well known manufacturer are employed. That firm participates in "Collaborative Planning, Forecasting and Replenishment" with a major retail chain. Through a stochastic simulation model, we contrast CPFR to Vendor Managed Inventory, and to Independent Sourcing. Comparisons are made on total system cost, aggregate inventory levels, and fill rates.

4 - Fair Supply Chains: Implications and Complications of Fair Trade in Supply Chain Modeling
M. Ali Ulku, Assistant Professor, School of Management and Leadership, Capital University, 1 College and Main, Columbus, OH, 43209, United States of America, aulku@capital.edu

Fair Supply Chains (FSCs) aim to achieve a greater equity in international trading, and thus, sustainable development. As consumers become more socially responsible, the demand and therefore the shelves for certified fair trade goods in big retailers have been expanding rapidly. In many aspects, FSCs greatly differ from Commercial Supply Chains (CSCs). This research introduces modeling challenges in FSCs and proposes a fairness-coordination mechanism that can be integrated to a global CSC.

■ TA39

39- North 226 C- CC

Supply Chain in Retail Management

Contributed Session

Chair: Arnd Huchzermeier, Professor, WHU - Otto Beisheim School of Management, Burgplatz 2, Vallendar, 56179, Germany, ah@whu.edu

1 - Impacts of Retailer's In-Store Marketing Effort in Private Label and National Brand Competition
Tieming Liu, Associate Professor, Oklahoma State University, 322 Engineering North, Industrial Eng and Management, Stillwater, OK, 74078, United States of America, tieming.liu@okstate.edu, Yingjue Zhou, Gangshu Cai

This paper examines a supply chain with a retailer selling a private label product (PL) and a national brand product (NB). We assume the retailer pays in-store marketing effort to promote sales. We study the retailer and the national brand manufacturer's pricing and marketing effort decisions. We show that under certain conditions, the retailer may assign the in-store marketing effort to NB, and the NB manufacturer may benefit from the introduction of PL.

2 - Selecting Store Delivery Patterns in Grocery Retailing
Michael Sternbeck, Catholic University Eichstaett Ingolstadt, Auf der Schanz 49, Ingolstadt, 85049, Germany, michael.sternbeck@ku-eichstaett.de, Heinrich Kuhn

We consider a grocery retail chain consisting of the three subsystems warehousing, transportation and instore-logistics. In this environment, determining store-specific delivery patterns is considered as an important interdependent problem in internal supply chain planning on a tactical level. We use an optimization approach to select store delivery patterns. The results show that integrating instore logistics is of major importance.

3 - Optimal Policies for Recovering the Value of Consumer Returns
Paolo Letizia, Assistant Professor, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, letizia@rsm.nl

This paper characterizes a Pareto optimal returns policy between a manufacturer and a retailer who receives consumer returns. The manufacturer may take a costly hidden action that reduces the expected number of products returned by consumers, which when realized is hidden information known only to the retailer. When faced with consumer returns, the retailer must decide whether to send the product back to the manufacturer, who harvests a low salvage value, or to engage in costly refurbishment that permits the returned product to be resold to consumers. We find that the optimal returns policy may be implemented through the payment by the manufacturer of a full refund to the retailer of the wholesale price for any returns, as well as a bonus paid to the retailer that is decreasing in the number of returns to the manufacturer.

4 - Returns Management and Secondary Markets
Arnd Huchzermeier, Professor, WHU-Otto Beisheim School of Management, Burgplatz 2, Vallendar, 56179, Germany, ah@whu.edu, David Schroeder

This presentation analyzes the optimal returns management policy of online retailers under competition and in the presence of a secondary market. A big data set of a pan European online retailer of fashion products — offering a free returns policy of up to 100 days after a customer's purchase — is utilized to provide new insights on actual customer behaviour and effective returns policies.

■ TA40

40- North 227 A- CC

Sustainable Practices and Innovations

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Xu (Cissy) Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 1 Amherst Street, E40-211, Cambridge, MA, 02142, United States of America, xu_yang@mit.edu

1 - Root Causes of Product Expiration in the Consumer Packaged Good Industry
Arzum Emel Akkas, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, aakkas@mit.edu, David Simchi-Levi

Our work investigates the root causes of product expiration at retail stores using archival operations data from a large beverage company. Using binomial regression, we quantify the impact of product configuration, warehouse aging of products, warehouse congestion, inventory policy, and suboptimal shelf arrangements on product expiration observed at retail stores.

2 - A Multiple-player-game Approach to Agricultural Water Use in Seasonal Drought Area: A Case in Brazil
Zhouyang Lu, Duke University, 121 Hudson Hall CEE, Box 90287, Durham, NC, 27708-0287, United States of America, zl49@duke.edu

Seasonally dry areas, widely distributed in the world, are facing an intensive disparity between the lack of water and the great demand of social development. This work discusses the guarantee of micro-irrigation running in dry season in Fazenda Tamandua. The effects of the landlord's supervision on the micro-irrigation are analyzed with a multiple-player game model. The outputs from the model and data show the influence of landlord's supervision on the moral hazard between the stakeholders.

3 - Modeling Multiple Objectives in Green Building Decision-making
John Dickson, University of Texas at Arlington, Arlington, TX, United States of America, john.dickson@uta.edu, Victoria Chen

Green building seeks to improve building sustainability. A decision-making framework is presented that utilizes design and analysis of computer experiments to study the impact of building options on sustainability objectives. The QUick Energy Simulation Tool (eQUEST) is employed to evaluate building performance. Modeling of multiple objectives is achieved using treed regression and treed multivariate adaptive regression splines with the seemingly unrelated regressions method.

4 - Collaborative Planning in Closed-loop Supply Chains
Aman Gupta, Assistant Professor, Embry-Riddle Aeronautical University-WorldWide, 10733 Copper Ridge Dr, Louisville, KY, 40241, United States of America, aman.gupta@erau.edu

Collaborative planning involves information sharing and coordination of the planning tasks of independent supply chain members. Collaboration or information sharing can be at different levels including, minimal, deep involvement, and somewhere in between. The research presents an overview of the literature published on impact of collaborative planning in managing closed-loop supply chains and potential future research in this area.

■ TA41

41- North 227 B- CC

Forestry Session II

Sponsor: Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Fire, Water and Owl: Multi-objective Forest Planning in the Deschutes National Forest, USA
Sandor Toth, Assistant Professor, University of Washington, School of Environmental and Forest Scien, Seattle, WA, 98195, United States of America, toths@uw.edu, Svetlana Kushch, Thomas Mafera, Leo Yanez, Gregory Ettl, Robert Deal

We present a multi-objective optimization application in a municipal watershed in the Deschutes National Forest, where water quality, spotted owl habitat, and fire risk mitigation are all critical but competing services. For example, fuel treatments increase sediment in the short run, but in the long run the risk of wildfires will be lower and sedimentation will be less.

2 - Anticipative Long Term Forest Planning
Sophie D'Amours, Université Laval, Department of Mechanical Engineering, Pavillon Adrien Pouliot, Quebec, QC, G1K 7P4, Canada, sophie.damours@forac.ulaval.ca, Mathieu Bouchard, Martin Simard, AchilleBenjamin Laurent, Sebastien Lemieux

This presentation will describe the challenging link between long term forest planning and industry development. It will showcase web-based advanced planning tools (SylviLab and LogiLab) supporting group decision making. Anticipation of the impact of the long term forest plan on industry and carbon balance will be explained. Multiple objectives are considered when selecting the best forest plans. Case studies from Canada will be presented.

3 - Preventing Orphan Stands in Spatially Explicit Forest Management Planning
Marc McDill, Associate Professor, Pennsylvania State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States of America, mem14@psu.edu, Susete Marques, Jose G Borges

For a variety of reasons, in spatially-explicit harvest scheduling models some management units typically will not be harvested within the planning horizon. Small unharvested management units may be too small to allow a viable harvesting operation, however, leaving these units as unusable "orphans" at the end of the planning horizon. We present a multi-objective formulation that minimizes the number of orphan units.

4 - Multiobjective Forest Management Model with Uncertain Weights
Cristian D. Palma, Universidad del Desarrollo, Faculty of Industrial Engineering, Santiago, Chile, cristianpalma@ingenieros.udd.cl, John D. Nelson

Defining weights in a multiobjective optimization framework is a difficult task, especially when many actors are involved in the decision-making process. We present a robust version of a multiobjective multiperiod forest management problem in which the weights are defined as a continuous range of possible values, and show that robust decisions produced more stable outcomes through the planning horizon than deterministic ones when weights may change over time.

■ TA42

42- North 227 C- CC

Shared Mobility Systems

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Virot Chiraphadhanakul, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, virot@mit.edu

1 - A Transportation Market for Ridesharing
Maged Dessouky, Professor, University of Southern California, University Park Campus, Los Angeles, CA, 90007, United States of America, maged@usc.edu, H. Xu, M. Furuhata, Fernando Ordonez, Sven Koenig, K. Daniel, X. Wang

We describe mechanisms and algorithms for negotiating routes and prices to facilitate a transportation market for ridesharing. We present a pricing model that fairly allocates the cost of the trip among all the passengers as well as ensures that it is always cheaper to request a ride as early as possible, an algorithm that routes and schedules the vehicles that minimizes the cost and passenger travel times, and a network equilibrium model that determines the optimal number of riders.

2 - Evaluating Impacts of Integrating Vehicle-Sharing Systems with an Existing Public Transit Network
Virot Chiraphadhanakul, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, virot@mit.edu, Cynthia Barnhart

Using publicly available transit schedules, we construct a public transit graph that enables us to identify an optimal transit route from one transit node to another based on various objective functions and constraints. We then augment the graph with additional nodes and arcs corresponding to different designs of vehicle-sharing systems and evaluate their impacts on trip times, commuter choices, and emissions. Empirical results from Boston metro area will be discussed.

3 - Managing Public Bike Sharing Systems by Demand Profile and Temporary Manpower Allocation
I-Lin Wang, Associate Professor, Department of Industrial and Information Management, National Cheng Kung University, No.1 University Rd., Tainan, Taiwan-ROC, ilinwang@mail.ncku.edu.tw

We consider the surveyed OD demand profile as a fixed input that defines the bikes emanating from each station in a proportional fashion. To achieve better service quality without moving bikes among stations by bike-repositioning vehicles, our first model calculates where and when to put caretakers for receiving more bikes in over-capacitated stations, whereas our second model seeks the best amount of volunteer riders to be invited for riding between some OD links at specific periods.

4 - Comparing Optimal Relocations with Realistic Simulated Relocation Policies in One-way Carsharing
Diana Jorge, University of Coimbra, Rua Luis Reis Santos, Coimbra, Portugal, dianarjorge@gmail.com, Cynthia Barnhart, Gonçalo Correia

The objective of this paper is developing a mathematical model that optimizes vehicle relocation operations given a trip pattern for a particular set of stations. A simulation model is also developed to apply different relocation policies for the same instances. We conclude that it is not possible to reach the optimum results using relocation policies. However both approaches lead to a significant increase in the profit of the company.

■ TA43

43- North 228 A- CC

Joint Session RAS/TSL: Railroad Optimization Models

Sponsor: Railway Applications & Transportation Science & Logistics

Sponsored Session

Chair: Aihong Wen, Manager Operations Research, CSX, 500 Water Street J300, Jacksonville, FL, 32224, United States of America, aihong_wen@csx.com

1 - Overview of Decision Support Systems for Intermodal Operations

Yudi Pranoto, Norfolk Southern Corporation, 1200 Peachtree Street N.E., Atlanta, GA, 30309, United States of America, yudi.pranoto@nscorp.com, Hyun-suk Yoon, Clark Cheng

We describe the application of forecasting and optimization methods in an asset management tool in used by the Intermodal Operations at Norfolk Southern.

2 - Movement Planner

Srinivas Bollapragada, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

A movement plan is a detailed plan for moving trains in a rail network over a time horizon of 8 to 12 hours. It includes planning meet locations where trains traveling in opposite directions can get past each other as well as pass locations where fast trains can get past slower trains traveling in the same direction. We developed and implemented a novel algorithm at a major railroad company to automatically dispatch trains to increase average train velocities and save up to $800 million a year.

3 - Improve Operations by Drayage Optimization

Xiaoqing Peter Sun, Sr. Engineer, Schneider National, 3101 S. Packerland Dr., Green Bay, WI, 54313, United States of America, sunp@Schneider.com, Kendall Bailey

An optimization decision support tool has been developed at Schneider National to assist dispatching decisions. The tool utilizes advanced mathematical programming techniques such column generation, resource constrained shortest path problem to generate driver tours. The tool meets all practical constraints such as different appointment windows, freight types, rush hours, different driver types. The tool has been utilized for the last few years and significant cost savings have been achieved.

4 - Train Design Optimization in a Congested Railroad Network

Abdullah Al Khaled, PhD Student, Mississippi State University, Department of Industrial and Systems Engg., McCain Engineering Building, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, ak511@msstate.edu, Mingzhou Jin

Train design in railways consists of two tasks: block-to-train assignment and train routing. It seeks to identify optimal routes for trains and their associated blocks and is subject to various capacity and operational constraints at tracks and yards. A mixed integer program is formulated for this problem considering nonlinear relationship between travel time and volume in a congested network. A two-stage heuristic algorithm is proposed to attack the computational burden for real-world networks.

■ TA44

44- North 228 B- CC

Supply Chain: Issues in Healthcare

Contributed Session

Chair: Raja Jayaraman, Assistant Professor, Khalifa University of Science Technology and Research, Department of Industrial & Systems Engg., Al Saada St. (19th) & 2nd Street, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae

1 - Pulling, Pooling, and Contracting under Heterogeneous Consumers

Gerardo Pelayo, Zaragoza Logistics Center, C/ Bari 55, Edificio Nayade 5 (PLAZA), Zaragoza, Spain, gpelayo@zlc.edu.es, Mustafa Cagri Gurbuz

We model a pharmaceutical manufacturer who owns a drug that a applies to a single (stochastic size) category of patients and can exert innovation effort aimed at creating a second (deterministic size) category who benefits differently from the drug. We analyze the stocking and effort decisions when reservation is not allowed under dedicated versus a single sales channel and find conditions under which pooling does not reduce total inventory nor achieves the efficient level of effort.

2 - The Role of Power in the Medical Equipment Supply Chain

Jurriaan de Jong, The Ohio State University, 3238 Ainwick Rd, Columbus, OH, 43221, United States of America, de-jong.5@osu.edu, W.C. Benton

Many health organizations are members of large powerful Group Purchasing Organizations (GPOs). We empirically analyze the role of supply chain power and the presence of a middleman, a GPO, in the medical equipment supply chain. In particular we study the effects first on relationships between manufacturers and the health organizations and between GPOs and the health organization and second on the performance of the respective supply chain members.

3 - Inventory Positioning in Clinical Trial Supply Chains

Yao Zhao, Associate Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, yaozhao@andromeda.rutgers.edu, Adam Fleischhacker, Anh Ninh

One bottleneck in clinical trials is the slow patient recruitment. Companies typically address this issue by recruiting patients globally, which, however, resulted in significant overages of clinical supplies. In this study, we introduce a class of mathematic models to capture the unique attributes of clinical trial supply chains. We show how to optimally position inventory in such supply chains, and test the effectiveness of the model in a real-world example.

4 - Mitigating the Effects of Drug Shortages in the Global Healthcare Supply Chains

Raja Jayaraman, Assistant Professor, Khalifa University of Science Technology and Research, Department of Industrial & Systems Engg., Al Saada St. (19th) & 2nd Street, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae, Young-Ji Byon, Young Seon Jeong

Globally healthcare supply chains face critical challenges in healthcare delivery due to shortages of essential and life saving drugs. It is often too difficult to distinguish between isolated and regular shortages. In this presentation we assess the information adequacy and resources needed to effectively manage drug shortages.

■ TA45

45- North 229 A- CC

Panel Discussion: How to Undertake Collaborative Research

Sponsor: Junior Faculty Interest Group

Sponsored Session

Chair: Halit Uster, Industrial and Systems Engineering, Texas A&M University, College Station, TX, United States of America, uster@tamu.edu

1 - Panel Discussion: How to Undertake Collaborative Research

Moderator: Halit Uster, Industrial and Systems Engineering, Texas A&M University, College Station, TX, United States of America, uster@tamu.edu, Panelists: Diego Klabjan, Eva Lee, Jon Lee, Warren Powell

Timely with increasing attention and excitement about collaborative and interdisciplinary research, the panel will discuss the making and the sustainment of successful collaborations among academics as well as between academics and practitioners.

■ TA46

46- North 229 B- CC

Disaster and Emergency Response I

Contributed Session

Chair: Sandro Paz, PhD Candidate / Associate Professor, University of South Florida / Pontificia Universidad Catolica del Peru, 18125 Birdwater Dr, Tampa, FL, 33647, United States of America, spaz@mail.usf.edu

1 - Dispatching and Relocation of Heterogeneous Emergency Vehicles

Elham Sharifi, PhD Candidate, University of Maryland, 1179 Glenn Martin Hall, College Park, United States of America, esharifi@umd.edu, Ali Haghani

Emergency response services play crucial roles in all communities and can minimize the adverse effects of emergency incidents by decreasing response time. Response time is not only related to the dispatching system, but also has a close relationship to the coverage of the whole network by emergency vehicles. The goal of this research is to develop a model that will dynamically dispatch some vehicles to emergency sites and also relocate others to provide better coverage for the future demands.

2 - Critical Infrastructure Management for Telecommunication Networks

Haibo Wang, Associate Professor, Texas A&M International University, 5201 University Blvd, Laredo, TX, 78041, United States of America, hwang@tamiu.edu, Bahram Alidaee, Wei Wang

Telecommunication network infrastructures play an important role to maintain the stability of society worldwide. This paper presents a critical infrastructure detection model to discover the interdependency based on the model from social network and new communication pathways. The policy and procedure of protecting critical infrastructures are discussed and computational results from the proposed model are presented.

3 - Optimize Pre-disaster Investment to Strengthen a Vulnerable Transportation Network

Kwangho Kim, Department of Civil and Environmental Engineering, University of California, 416F McLaughlin Hall, Berkeley, United States of America, khkim@berkeley.edu, Yoonjin Yoon

A bi-level programming algorithm is developed to optimize pre-disaster resource allocation to strengthen a vulnerable transportation network by considering system-wide network vulnerability. The proposed algorithm is tested on a medium-size network to evaluate the benefit of employing vulnerability analyses to suitably predefine choice sets of candidate investment strategies. The proposed methodology would advance the existing knowledge on pre-disaster infrastructure management.

4 - A Framework to Evaluate System-wide Vulnerability of a Transportation Network under Disasters Events

Sehyun Tak, PhD. Candidate, KAIST, Yuseong-Gu, 335 Gwahangno, Daejeon, 305-701, Korea, Republic of, taksehyun@kaist.ac.kr, Kwangho Kim, Yoonjin Yoon

It is important to assess vulnerability of transportation network in disaster management. In our study, we identify critical links of transportation network under user equilibrium by evaluating system travel time in the pre and post disasters. We adopt a simulation study and apply a set of scenarios by varying demand as well as network connectivity.

5 - Antiviral Resistance and Mitigation of Pandemic Influenza

Sandro Paz, PhD Candidate/Associate Professor, University of South Florida/Pontificia Universidad Catolica del Peru, 18125 Birdwater Dr, Tampa, FL, 33647, United States of America, spaz@mail.usf.edu, Alex Savachkin

We are building a large-scale simulation optimization framework for antiviral based mitigation of pandemic influenza. The model considers an oseltamivir-sensitive strain and a resistant strain with low/high fitness cost. Mitigation strategies include treatment of symptomatic cases and chemoprophylaxis of pre- and post-exposure cases.

■ TA47

47- North 230- CC

Dynamic Traffic Assignment I - New Modeling Approaches

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Chung-Cheng Lu, National Taipei University of Technology, 1 Section 3, Chung-Hsiao East Road, Taipei, Taiwan - ROC, jasoncclu@gmail.com

1 - A Game-Theoretic Perspective on Dynamic Network Equilibrium

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, Christopher Melson

Dynamic network equilibrium is much more complex than static equilibrium. Equilibrium may not be unique, and may not even exist in pure strategies, which is significant for simulation-based dynamic traffic assignment. This presentation discusses several small examples of these issues, and introduces a game-theoretic perspective which may be useful in resolving them.

2 - A Nonlinear Integer Program for Vehicle-based Dynamic Traffic Assignment

Chung-Cheng Lu, National Taipei University of Technology, 1 Section 3, Chung-Hsiao East Road, Taipei, Taiwan-ROC, jasoncclu@gmail.com, Kuilin Zhang, Xuesong Zhou

We propose an innovative nonlinear integer program for vehicle-based dynamic traffic assignment problems. The objective function is a vehicle-based gap function that measures the deviation from dynamic user equilibrium. This model describes dynamic traffic propagations and handles first-in-first-out requirements with a set of linear constraints. In addition, a set of time connectivity constraints provides facets of the convex hull, so the solutions of the LP relaxation of the integer program are almost always integral, and rounding heuristics or branch-and-bound are not required. A numerical example is presented to demonstrate the integral property of the model.

3 - Price of Anarchy in Dynamic Traffic Networks: A Computational Study

Satish Ukkusuri, Associate Professor, Purdue University, 550 Stadium Mall Drive, G175F, West Lafayette, IN, 47906, United States of America, sukkusur@purdue.edu, Kien Doan

Price of Anarchy is described as the worst case difference between the equilibrium and optimum solution thereby measuring the inefficiency in traffic networks. This study will demonstrate the price of anarchy in dynamic traffic networks. A brief review of the dynamic equilibrium and dynamic system optimum models will be provided. Extensive computational analysis will demonstrate the price of anarchy in various traffic networks. Open questions of interest to the research community will be discussed.

4 - Stability and Convergence in Large-scale Dynamic Traffic Assignment

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, C. Matthew Pool

This work reviews, implements and compares existing techniques for finding equilibrium solutions in simulation-based dynamic traffic assignment and proposes novel approaches. Numerical experiments assess the convergence and stability properties of these approaches in realistic-sized networks.

■ TA48

48- North 231 A- CC

Port Operations and Shipping Logistics

Sponsor: Transportation Science & Logistics/ Freight Transportation & Logistics

Sponsored Session

Chair: Yun Fong LimAssistant Professor, Singapore Management University, 50 Stamford Road, #04-01, Singapore, SG, Singapore, yflim@smu.edu.sg

1 - A Quay Crane System That Self-Recovers from Random Shocks

Yun Fong Lim, Assistant Professor, Singapore Management University, 50 Stamford Road, #04-01, Singapore, SG, Singapore, yflim@smu.edu.sg, Yan Zhang

The main challenge for a container terminal is to maximize its throughput using limited resources subject to various operational constraints. Traditional approaches often require re-planning when the system is subject to random shocks. We propose an operating protocol to coordinate the cranes so that the system spontaneously recovers from shocks and persistently restores its throughput near its full capacity.

2 - Optimal Scheduling for the Inland Transport of Containers: Facing the Trade-off of Costs, Efficiency and Sustainability

Stefano Fazi, Eindhoven University of Technology, Lismortel, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, s.fazi@tue.nl, Jan Fransoo, Tom van Woensel

We present an allocation model for a particular container supply chain where multiple sea terminal quays and a hinterland terminal are considered. From the moment a container is dropped off from the vessels at the sea terminals, several options for the final transportation to the hinterland can be considered: trucks, barges and trains. The logistic planner decides the best allocation for the containers to the available means of transport. The objective is to minimize the costs for the transportation while guaranteeing a high service level and low congestion at the sea terminal.

3 - Berth Allocation Problem Considering Fuel Consumption and Vessel Emissions in a Decentralized Decision Environment

Yueran Zhuo, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, yzhuo@som.umass.edu, Yuquan Du

We focus on the berth allocation problem considering fuel consumption and vessel emissions in a decentralized decision environment. We model and solve this problem by deploying a multi-agent system, where the optimal sailing speed of each vessel is obtained by an iterative negotiation process between the terminal and vessels. Experimental results show that the model can significantly reduce fuel consumption and vessel emissions in sailing periods.

4 - A Proactive International Shipment Consolidation Strategy
Wooseung Jang, Professor, University of Missouri, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, jangw@missouri.edu, Na Deng

We consider an integrated multi-commodity consolidation and shipping problem, which occurs in an international supply network. We propose a proactive strategy that consolidates shipment, considering both ocean and subsequent inland transportation activities. A combinatorial optimization model is proposed and numerical analysis shows significant cost savings of our approach.

■ TA49

49- North 231 B- CC

Joint Session TSL/SPPSN: Evacuation Planning

Sponsor: Transportation Science & Logistics & Public Programs, Service and Needs

Sponsored Session

Chair: Yue Liu, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, WI, 53201, United States of America, liu28@uwm.edu

1 - Integrated Demand-supply Management Framework and Risk-based Routing for Evacuation Operations
Yu-Ting Hsu, Purdue University, 3000 Kent Ave., Nextrans Center, West Lafayette, IN, 47906, United States of America, yhsu@purdue.edu, Srinivas Peeta

We propose an operational framework for mass evacuation which integrates demand and supply management perspectives. It incorporates evacuee behavior models for evacuation recommendation and route guidance. A risk-based routing strategy is adopted that seeks to evacuate the population with the highest risk first by disseminating information to it. It introduces a risk management perspective and also circumvents expensive iterative computation, thereby enabling real-time evacuation operations.

2 - Optimal Decision-making between Signalized and Uninterrupted Flow Strategies during Evacuation
Zhenke Luo, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, WI, 53201, United States of America, zluosr@uwm.edu, Yue Liu, Jing Mao

This paper presents a bi-level network optimization model to determine the optimal set of intersections in the evacuation network for implementing uninterrupted flow and signal control strategies, respectively, which can yield the maximum evacuation operational efficiency and the best use of available budgets. The proposed model is solved by a GA-based heuristic.

3 - Determination of the Onset and Duration of Contraflow Operations under Uncertainties
Yingyan Lou, Assistant Professor, The University of Alabama, 260 H.M. Comer, Tuscaloosa, AL, 35487, United States of America, ylou@eng.ua.edu, Daniel Fonseca, Gary Moynihan, Peiheng Li, Saravanan Gurupackiam

This research addresses the determination of the onset and duration of contraflow operations for hurricane evacuation planning. A modeling framework is developed featuring (1) an underlying traffic flow model to describe traffic dynamics; (2) incident identification and characterization using artificial intelligence; (3) various optimization techniques for decision making under uncertainties; and (4) a computer-based decision support system. A case study of I-65 in Alabama is provided.

4 - Integrated Modeling of Hurricane Evacuation Decision Making: An Interdisciplinary Perspective
Binh Luong, Purdue University, 550 Stadium Mall Drive, G175F, West Lafayette, IN, 47906, United States of America, lthbinhhnvn@gmail.com, Samiul Hasan, Kien Doan, Rodrigo Mesa-Arango, Sattish Ulkusuri

The goal of this talk is to describe an integrated modeling approach for hurricane evacuation modeling from behavioral and simulation modeling. Various behavioral dimensions that influence households to evacuate will be discussed including the timing of evacuation, the destination choice and route choice. The models are estimated with data from Hurricane Ivan. A large scale simulation model will be demonstrated to show the efficiency of the evacuation clearance times.

■ TA50

50- North 231 C- CC

Military Manpower Planning Models and Applications

Sponsor: Military Applications

Sponsored Session

Chair: Patrick DownesPhD Candidate, University of Texas/ United States Army, 2716 Dupree Lane, Austin, TX, 78748, United States of America, patrick.downes@phd.mccombs.utexas.edu

1 - Manpower Planning Models for U.S. Army Medical Department: Optimization and Simulation Approaches
Patrick Downes, PhD Candidate, University of Texas/ United States Army, 2716 Dupree Lane, Austin, TX, 78748, United States of America, patrick.downes@phd.mccombs.utexas.edu

The U.S. Army uses optimization models to manage manpower policies. We present how current objective force models of the Army Medical Department can be extended to provide optimal manpower policies for the current force. We study two models: a linear goal program and a system dynamics model. The first is an extension of current models used today and the system dynamics model includes the study of how an individual's probability of continuation is influenced by additional, important factors.

2 - Project Selection and Manpower Planning in the Colombian Navy
Andrès L. Medaglia, Associate Professor, Universidad de los Andes, Departamento de Ingenieria Industrial, Carrera 1 Este # 19 A-40, Bogotá, Colombia, amedagli@uniandes.edu.co, Miguel Barrios, Wilson Flórez, Maria A. Londoño, Jorge Sefair, Juan D. Palacio, Juan D. Ortiz, Flor Sánchez, Mauricio Mejía

To make a better use of its resources and to leverage negotiation with the Defense Ministry and the Colombian Planning Department, the Colombian Navy (ARC, for its acronym in Spanish) has developed a Web-based decision support system to select and schedule a bank of projects. Many of these projects (e.g., acquisition of a new coast guard patrol boat) have a direct impact on manpower planning. Thus, a second decision support tool allows the ARC to estimate costs and properly plan its workforce.

■ TA51

51- North 232 A- CC

Tutorial: Managing Spare Parts

Sponsor: Military Applications

Sponsored Session

Chair: Thomas Willemain, Vice President, Smart Software, Inc., 4 Hill Road, Belmont, MA, 02478, United States of America, tomw@smartcorp.com

1 - Tutorial: Managing Spare Parts
Thomas Willemain, Vice President, Smart Software, Inc., 4 Hill Road, Belmont, MA, 02478, United States of America, tomw@smartcorp.com

This tutorial is for people new to this topic, covering the basics and emphasizing applied topics: key issues in management of military (and public sector) spare parts, performance metrics, probability models used in forecasting demand, software systems, connections to basic inventory control theory, and pointers to the literature.

■ TA52

52- North 232 B- CC

Evaluating the Controllability of a System of Plug-in Hybrid Electric Vehicle Charging Stations

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Department Ind. & Manuf. Sys. Engr., Arlington, TX, United States of America, vchen@uta.edu

1 - Adaptive Design for Controllability of Charging Stations for Plug-in Hybrid Electric Vehicles

Amirhossein Khosrojerdi, Graduate Research Assistant, University of Oklahoma, 202 W. Boyd Street, Norman, OK, 73071, United States of America, akhosrojerdi@ou.edu, Piampoom Sarikprueck, Asama Kulvanitchaiyanunt, Janet K Allen, Victoria Chen, Minting Xiao, Jay Rosenberger, Wei-Jen Lee, Salman Ahmed, Farrokh Mistree

A system of PHEV charging stations is evolving as parameters change over time. The simultaneous design of the control systems and the infrastructure to support it will result in both enhanced controllability and provide a more efficient design process. We focus on the modular view of designing a system whose performance is determined by their ability to be controlled and on a method which produces robust systems which can evolve effectively. The focus is on the method, rather than the results.

2 - Modeling and Forecasting Towards Adaptive Design of a System of PHEV Charging Stations

Piampoom Sarikprueck, The University of Texas at Arlington, 416 Yates Street, Nedderman Hall Room 517-518, Arlington, TX, 76011, United States of America, piampoom.sarikprueck@mavs.uta.edu, Wei-Jen Lee, Asama Kulvanitchaiyanunt, Victoria Chen, Jay Rosenberger

The proposed model for PHEV charging stations consists of energy resources, controller, battery, converter, and inverter. The main energy resources are utility grid integrated with wind from a single wind farm and solar energy generated at each station. The charging stations will provide DC fast charging and can sell back energy to the grid. Forecasting results of wind and solar energy as well as market prices are carried out to provide information for system design and optimal dynamic control.

3 - Discrete Event Simulation of Demand at PHEV Charging Stations

Minting Xiao, University of Oklahoma, 202 W. Boyd St., Room 116, Norman, OK, 73019-0631, United States of America, mintingx@ou.edu, Salman Ahmed, Janet K Allen, Farrokh Mistree

Discrete-event simulation is used to predict the demand for energy at a PHEV charging station. Ranges of demand are predicted based on historical projections and anticipated policy decisions and this information is used in the discrete event simulation. Further uncertainty is incorporated in the model based on expected fluctuations in charging at different times of day. The simulation of demand from one charging station can be then extended to the system of charging stations.

4 - Stochastic Dynamic Control for PHEV Charging Stations

Asama Kulvanitchaiyanunt, The University of Texas at Arlington, 416 Yates Street, Arlington, TX, United States of America, asama.kulvanitchaiyanunt@mavs.uta.edu, Piampoom Sarikprueck, Victoria Chen, Jay Rosenberger, Wei-Jen Lee

An infinite horizon policy for a continuous-state stochastic dynamic program is proposed to control a system of plug-in hybrid electric vehicle (PHEV) charging stations. The martingale model of forecast evolution is used to represent uncertainties for wind farm power generation, solar power generation at each charging station, and nodal market price. Due to the large-scale nature of the problem, an approximate dynamic programming based on design and analysis of computer experiments is developed.

■ TA53

53- North 232 C- CC

Advanced Models and Algorithms for Power Grid Design and Operations

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Bo Zeng, Assistant Professor, University of South Florida, 4202 E Fowler Ave ENB118, Tampa, FL, 33620, United States of America, bzeng@usf.edu

1 - Fully Decentralized AC Optimal Power Flow Algorithms

Andy Sun, Postdoctoral Researcher, IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, andysun@us.ibm.com, Dzung Phan, Soumyadip Ghosh

Motivated by the increasing complexity in the control of electric power systems especially in a smart grid environment, we propose fully decentralized algorithms to solve AC OPF problems. The key feature of our algorithms is a complete decentralization of computation down to nodal level, where the problem is solved by individual nodes with only local knowledge. Our algorithms have computation complexity of linear growth and can adapt to network topology changes without central coordination.

2 - Worst-case Contingency-constrained Expansion Planning for Power Systems

Neng Fan, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87185, United States of America, nnfan@sandia.gov

In this talk, we include the constraints of the N-k contingency into the planning process, such that the system can still run normally in case of contingencies with multiple simultaneous loss of the system elements. Robust optimization method is used to identify the worst-case contingency for analysis. In the operation level, the technique of line switching is added to check the benefits comparing with the situation without line switching.

3 - Robust Temperature Modulated Unit Commitment Problem

Bo Zeng, Assistant Professor, University of South Florida, 4202 E Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Anna Danandeh

The efficiency of gas generators is heavily affected by the temperature of the inlet air, which could be 10% loss. Hence, classical unit commitment models may not yield feasible solutions to meet load demand. We consider a two-stage unit commitment problem where temperature in next 24 hour is random, and present solution algorithms for this new type robust optimization problem.

4 - Two-stage Stochastic Unit Commitment Models With Energy Storage and Demand Response

Yuping Huang, Graduate Research Assistant, West Virginia University, 478 Harding Ave., Apt 7, Morgantown, WV, 26505, United States of America, yhuang8@mix.wvu.edu, Qipeng Zheng

Demand response is a key component of smart grid and energy storage is crucial for making variable renewable energy sources once they're connected to power grid. This study is to develop two-stage stochastic programming models for unit commitment with energy storage, with demand response, and with both resources. Numerical experiments are conducted to compare the effects of both resources on power generation.

■ TA54

54- Regency Ballroom A- Hyatt

Business Innovation Cases in Korean Firms

Cluster: KINFORMS (Korea Chapter—INFORMS)

Invited Session

Chair: Sang Hyung Ahn, Seoul National University, School of Business, Seoul, Korea, Republic of, shahn@snu.ac.kr

1 - Process-based Service Quality Assessment of Automobile Maintenance Service

Hosun Rhim, Professor, Korea University Business School, Anam-dong, Seongbuk-gu, Seoul, 136-701, Korea, Republic of, hrhim@korea.ac.kr, Hye-Jun Gil, Geon-Ha Kim, Kil-Hang Wang

We measure and evaluate the service quality of auto repair service. Service is measured by stages of service process. We investigate relationships among the service quality of auto repair center, customer loyalty toward auto maintenance center, and repurchase intention of automobile. We conducted an online survey and collected a sample of size 3,028.

2 - An Analysis of Rotating Savings and Credit Associations
Deung-Geon Ahn, KAIST, Industrial and Systems Eng., Daejeon, Korea, Republic of, holmes325@kaist.ac.kr, Wanmo Kang, Kyoung-Kuk Kim, Hayong Shin

Rotating Savings and Credit Association (ROSCA) is a well-known and widely used informal financial association in many countries around the world. However, the ROSCA has not been much investigated at the quantitative level. This work analyzes the structure and probability, compared to bank transactions, of one type of ROSCAs which has a very long history in the East Asia. Unlike the previous studies, we approach the ROSCA using replication as often done in financial engineering. We identify some conditions that lead to existence of such private credit associations and optimal orders of participants in such systems.

3 - Supply Chain Risk Management Strategy
Chang Won Lee, Professor and Chair of Operations and Service Management, Hanyang University, Seoul, 133-791, Korea, Republic of, leecw@hanyang.ac.kr, Sang Hyung Ahn

The study present current supply chain risk management strategy in terms of global perspective. The background has been reviewed and research model is developed. Empirical study is conducted and results are analyzed and discussed. The managerial insights for global supply chain risk management strategy has been provided.

4 - A Parametric Analysis for a Risk-averse Newsvendor
Sungyong Choi, Assistant Professor, Yonsei University, 1 Yonseidae-gil, Wonju, 220-710, Korea, Republic of, sungyongchoi@gmail.com

I consider a multi-product risk-averse newsvendor with the mean-CVaR (Conditional Value-at-Risk) model. I establish a parametric analysis for the model. Then, I prove the impacts of number of products and degree of risk aversion to the problem in independent demand case. For dependent demands, I conduct a special case analysis to obtain a closed-form solution. A numerical study confirms my analytical results to show how risk aversion and dependent demands jointly affect to the optimal solution.

5 - New Quality as a Competitive Weapon in Korean Automotive Industry
Youn Sung Kim, Inha University, Korea, Republic of, keziah@inha.ac.kr

Quality is one of the most important issues in many companies. After the Toyota crisis, many companies are trying to enhance the quality level and reduce the quality problem. So in this research, we try to find out "how to reenergize their quality focus", especially in Korean automotive industry.

■ TA56

56- Curtis A- Hyatt

Joint Session TMS/ORG: Managing Product Configuration and Improvement

Sponsor: Technology Management & Organization Science

Sponsored Session

Chair: Zhijian Cui, Assistant Professor of Operations Management, IE Business School, Calle de Maria de Molina, 12, Madrid, 28006, Spain, Zhijian.Cui@ie.edu

1 - Product Configuration, Ambidexterity and Firm Performance
Fabrizo Salvador, Professor, IE Business School, Calle Maria de Molina 12-5, Madrid, Ma, 28006, Spain, Fabrizio.Salvador@ie.edu

We identify two firm-level abilities–namely, product configuration effectiveness (PCE) and product configuration intelligence (PCI)–that explain how product configuration impacts firm performance. We link PCE and PCI to exploration and exploitation and, following the ambidexterity argument, propose that their interaction is associated to superior operational and financial performance. We find empirical support the ambidexterity argument relative to sales, but not to profit.

2 - Joint Product Improvement by Client and Customer Support Center: The Role of Gain-Share Contracts
Sameer Hasija, INSEAD, Fontainbleau, France, sameer.hasija@insead.edu, Shantanu Bhattacharya, Alok Gupta

We study the role of different contract types in coordinating the joint product improvement effort of a client and a customer support center. The customer support center's costly efforts include transcribing and analyzing customer feedback, analyzing market trends, and investing in product design. We show the role of gain-share contracts in resolving the agency issues present is such settings.

3 - Optimizing the Resource Allocation of an Entrepreneur: The Role of Learning Externalities
Onesun Yoo, University College London, Gower Street, London, WC1E 6BT, United Kingdom, onesun.yoo@ucl.ac.uk, Bilal Gokpinar, Yufei Huang

We study the problem of an entrepreneur trying to sell his service to two potential buyers by providing them information about the service. Buyers learn and update their beliefs about the service quality both directly from the entrepreneur himself, and indirectly through the purchase decision of the other buyer. By developing an analytical model, we characterize this learning and purchasing process, and analyze the optimal resource allocation policy for the entrepreneur.

4 - Collaborative Search
Fabian Sting, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, FSting@rsm.nl, Jurgen Mihm, Christoph Loch

Search has become a widely accepted paradigm to describe innovation activities. Formal models of search have incorporated a broad spectrum of different aspects relevant to search, such as cognition or organizational embedding. We contribute to the understanding of search by studying under which circumstances it is beneficial to have several organizational players search collaboratively.

■ TA57

57- Curtis B- Hyatt

Applied Probability and Financial Engineering

Sponsor: Applied Probability

Sponsored Session

Chair: Martin Haugh, Columbia University IE&OR, 500 West 120th Street, Mudd 332, New York, NY, 10027, United States of America, mh2078@columbia.edu

1 - Transform Formulae for Linear Functionals of Affine Processes and their Bridges on PSD
Wanmo Kang, Assistant Professor, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, Korea, Republic of, Wanmo.kang@kaist.edu, Chulmin Kang

We derive transform formulae for linear functionals of affine processes and their bridges whose state space is a set of positive semidefinite matrices. We investigate the relationship between such transforms and certain integral equations. Our findings extend and unify the existing results on affine processes and squared Bessel functionals, respectively. We also derive analytic expressions for Laplace transforms of some functionals of Wishart bridges. This is a joint work with Chulmin Kang.

2 - Simulated Likelihood Inference for Jump-diffusions
Gustavo Schwenkler, Stanford University, 1045 Alma St., Palo Alto, CA, 94301, United States of America, gschwenk@stanford.edu, Kay Giesecke

We develop likelihood estimators for the parameters of a discretely observed jump-diffusion with state-depend drift, diffusion and jump intensity functions. The estimators are based on a novel representation of the transition density that can be computed exactly using an exact sampling algorithm. We provide conditions for consistency and asymptotic normality of the estimators. Numerical results illustrate our approach.

3 - Value and Policy Iterations with Information Relaxation to Stochastic Dynamic Programming
Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, Hong Kong-PRC, nchen@se.cuhk.edu.hk, Wei Yu

We use the information relaxation technique to develop a value-and-policy iterative method to solve discrete time dynamic programming problems. Both value and policy converges to the optimal ones within finite steps of iterations.

■ TA58

58- Phoenix East- Hyatt

Advances in Stochastic Optimal Control and Learning II

Sponsor: Applied Probability

Sponsored Session

Chair: Ciamac Moallemi, Associate Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10025, United States of America, ciamac@gsb.columbia.edu

Co-Chair: Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vivekf@mit.edu

1 - Feature Search on the Grassmanian Manifold for Reinforcement Learning

Vivek Borkar, Indian Institute of Science, Deaprtment of Electrical Engineering, Bangalore, 400076, India, borkar.vs@gmail.com, K.J. Prabuchandran, Shalabh Bhatnagar

We address the problem of finding the best features in reinforcement learning with linear function approximation. Specifically, we consider TD(0) with linear function approximation for the infinite horizon discounted cost Markov decision process, wherein the number of 'basis' features is fixed. The feature vectors are adapted on a slower time scale by using a gradient descent on the Grassmanian manifold. This involves explicit gradient computation based on the Edelman{Arias{Smith formula and a secondary learning algorithm based on the same. Convergence properties of the combined scheme are established using two time scale stochastic approximation theory and the standard 'limiting o.d.e.' approach to stochastic approximation. Simulation experiments show very good results.

2 - Means, Variances and Limiting Distributions in Finite-horizon Markov Decision Problems

Alessandro Arlotto, Duke University, The Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27708, United States of America, alessandro.arlotto@duke.edu, J. Michael Steele, Noah Gans

The literature for Markov Decision Problems is huge but, despite a shared culture with the rest of applied probability, there are surprisingly few limit theorems for general classes of MDPs. This talk focuses on martingale (and other) methods that work well to obtain properties of the variance, and possibly of the distribution, for the total reward of some particular classes of finite-horizon MDPs.

3 - Information Relaxation Bounds for Infinite Horizon Dynamic Programs

David Brown, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, dbbrown@duke.edu, Martin Haugh

We study the use of information relaxations to compute upper bounds for a general class of infinite horizon stochastic dynamic programs. A challenge in using this approach for such problems is that probabilities in general depend on actions: even with perfect information, the subproblems may not be easy to solve. We discuss some approaches for dealing with this challenge and illustrate these approaches in some applications.

■ TA59

59- Phoenix West- Hyatt

Optimal Control Policies I

Sponsor: Applied Probability

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, ME 3258, Madison, WI, United States of America, ananth@engr.wisc.edu

1 - Dynamic Inventory Control with Limited Capital and Short-term Financing

Xiting Gong, University of Michigan, 1205 Beal Avenue, Room 1815, Ann Arbor, MI, 48109, United States of America, xitingg@umich.edu, Xiuli Chao, David Simchi-Levi

We study a dynamic inventory control problem where a firm with some limited initial capital periodically purchases a product from a supplier and sells it to a market with random demands. In each period, besides using its own capital, the firm can also borrow a short-term loan to purchase the product, with the loan interest being an increasing convex function of the loan size. We characterize the structure of the optimal inventory policy that maximizes the firm's expected terminal wealth.

2 - Throughput Maximization for Tandem Queues with Synergistic Servers

Xinchang Wang, Georgia Institute of Technology, Room 316 Main Building, 755 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, xwang336@gatech.edu, Sigrún Andradóttir, Hayriye Ayhan

We consider tandem queues with servers that work more efficiently in teams than on their own. The synergy among collaborating servers can be station-dependent. We provide a complete characterization of the optimal policy for Markovian systems with two stations and two servers. For larger systems, we provide sufficient conditions that guarantee that the optimal policy has all servers working together at all times.

3 - Optimal Production Inventory Strategies for Manufacturing Systems with Seasonal Demands

Sanket Bhat, University of Wisconsin-Madison, 1513 University Avenue, Room 3251, Madison, WI, 53726, United States of America, sbhat2@wisc.edu, Ananth Krishnamurthy

We analyze manufacturing firms that can vary production capacities and target inventory levels to adapt to the seasonal demands for products. Based on a dynamic programming model, we identify and characterize the structure of the optimal policies. We also identify the optimal production capacities and length of the production runs for each season.

4 - Shortest Queue and Polling

Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, iadan@tue.nl, Vidyadhar Kulkarni

In this talk we consider a two-station cyclic polling system with exhaustive service. The service times are exponential. Customers arrive to this system according to a Poisson stream and join the shortest queue (including the customer in service, if any). When both queues are equal they join the station where the server is. For this system we derive the steady-state joint queue length distribution.

■ TA60

60- Remington- Hyatt

Airport Capacity Frontier Analysis: Current Methods, Tools and Findings: Part I

Sponsor: Aviation Applications

Sponsored Session

Chair: Dipasis Bhadram, Senior Economist, USDOT/FAA, 800 Independence Avenue, Washington, DC, DC, 20009, United States of America, dipasis.bhadra@faa.gov

1 - Using Runway Assignment to Help Assess Aircraft Taxi-in Delay

Derek Robinson, Operations Research Analyst, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC, 20591, United States of America, Derek.Robinson@faa.gov

The objective of this study is to investigate aircraft taxi-in times at Core 30 airports. Most taxi-in analyses compare actual taxi times to a nominal time which only considers the airport and the operating carrier. We include runway assignment in our analysis. Using runway ends to determine the nominal taxi time can change the conclusions drawn from an assessment of those taxi times. In this investigation, we plan to compare delay results produced using both methods of defining a nominal time.

2 - The 2012 Update to the Airport Capacity Benchmarks

Jennifer Gentry, Lead Analyst, CAASD/MITRE Corporation, 7515 Colshire Avenue, McLean, VA, 22102-7539, United States of America, jenniferg@mitre.org

The FAA has updated its Airport Capacity Benchmark Report. The report, first published in 2001 and updated in 2004, presents benchmark capacity ranges derived from Facility Reported Rates and modeled capacities. The 2012 update was motivated by changes in aviation, construction of new runways, and improved modeling techniques.

3 - runwaySimulator

Peter Kuzminski, Principal Staff, CAASD/MITRE Corporation, 7515 Colshire Avenue, McLean, VA, 22101, United States of America, petekuz@mitre.org

Come learn about The MITRE Corporation's runwaySimulator simulation tool, used to estimate airport capacities for the Federal Aviation Administration's Airport Capacity Benchmark Report, the Future Airport Capacity Task, system-wide analyses, and other domestic and international work. An improved model and software will soon be available to the public.

■ TA61

61- Russell- Hyatt

Homeland Security Analytics - I

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: Barry EzellChief Scientist, Virginia Modeling, Analysis and Simulation Center, 1030 University Blvd, Suffolk, VA, 23435, United States of America, bezell@odu.edu

1 - Challenges for Public Sector Analytics

Evan Levine, Chief Scientist, DHS Risk and Capability Analytics, Risk and Decision Analysis Directorate, 201 Varick St., 5th Flr-NUSTL, New York, NY, 10014, United States of America, evan.levine@HQ.DHS.GOV

The growth of analytics in the public sector faces different challenges than in the private sector. Though opportunities to apply analytics in the public sector abound, cultural, organizational and technical challenges must be surmounted before government agencies can claim to be fully developed, enterprise-wide, analytically competitive organizations. The discussion will include examples of these challenges, as well as the progress being made to surmount them.

2 - Using Computable General Equilibrium Models to Estimate the Economic Impacts of Homeland Security Hazards

Tony Cheesebrough, Director, DHS-Risk and Capability Analytics, 61 Walnut Avenue, Takoma Park, MD, 20912, United States of America, tony.cheesebrough@HQ.DHS.GOV, Antonio Kirson, Jessica Smith, Nong Nai, Ryan Wise

Computable General Equilibrium (CGE) Models represent the state of the art in economic impact analysis. With assistance from the University of Southern California's Center for Risk and Economic Analysis of Terrorism Events (CREATE), the U.S. Department of Homeland Security (DHS) has recently begun to develop a CGE model to advance the input-output (I-O) models currently used to estimate losses associated with terrorism, natural hazards, transnational crimes, and industrial accidents.

3 - Designing Independent Verification and Validation for DHS Terrorism Risk Analysis

Barry Ezell, Chief Scientist, Virginia Modeling, Analysis and Simulation Center, 1030 University Blvd, Suffolk, VA, 23435, United States of America, bezell@odu.edu, Dennis Buede, Joe Tatman, John Lathrop

This presentation presents the research and design for conducting independent verification and validation of terrorism risk analysis. The research synthesizes generally accepted best practices in U.S. Department of Defense and leading scholarly research. The design was then applied to a specific risk assessment. The presentation describes many challenges and lessons learned in the process.

■ TA62

62- Borein A- Hyatt

Bidding in Auctions

Cluster: Auctions

Invited Session

Chair: Lin Hao, Assistant Professor, University of Notre Dame, Mendoza College of Business, Notre Dame, IN, 46556, United States of America, lhao@nd.edu

1 - Strategic Bidding in Reverse Split-award Auctions

Kemal Guler, Hewlett Packard Labs, 1501 Page Mill, Palo Alto, CA, United States of America, kemal.guler@hp.com, Xiaoyong Zheng, Stefan Mayer, Martin Bichler

We develop two competing first-price sealed-bid procurement auctions for selling a bundle of products through two lots with different sizes. We find that though the two auction mechanisms yield the same expected procurement costs to the buyer, other aspects of the two models, including the equilibrium bidding strategies as well as winning bidders' ex post profits differ significantly. The Bayesian-Nash equilibrium bid function also serves as a good predictor for bidding strategies in the lab.

2 - Revenue-monotonicity in Combinatorial Auctions

Marion Ott, RWTH Aachen University, Templergraben 64, Aachen, 52062, Germany, marion.ott@rwth-aachen.de, Marissa Beck

Under what conditions does revenue in sealed-bid combinatorial auctions decrease when bids increase? We investigate revenue-(non)monotonicity in the Vickrey Package Auction and Core-Selecting Auctions. In the Vickrey auction and in Minimum-Revenue Core-Selecting Auctions this counterintuitive phenomenon may appear even if we restrict bidders' values to be submodular and under further restrictions.

3 - Hierarchical Model for Estimating Values in Sponsored Search

Eric Sodomka, PhD Candidate, Brown University, 115 Waterman Street, 4th Floor, Providence, RI, United States of America, sodomka@cs.brown.edu, Dustin Hillard, Sebastien Lahaie

We propose an approach to predicting sponsored search advertisers' keyword values based on bidding behavior across the terms and campaigns in an account. We propose an economically meaningful loss function which allows us to implicitly fit a hierarchical linear model for values given observables such as bids and click-through rates. Its predictive quality is evaluated on several high-revenue and high-exposure advertising accounts on a major search engine.

4 - An Empirical Analysis of Bidding Behavior in Overlapping Online Auctions

Lin Hao, Assistant Professor, University of Notre Dame, Mendoza College of Business, Notre Dame, IN, 46556, United States of America, lhao@nd.edu, Arvind Tripathi, Yong Tan

This paper studied bidding behavior in overlapping online auctions. We investigated how bidders choose their bids when multiple identical auctions are running concurrently. We identified factors affecting bidders' decisions on which auction to bid. We also revealed how single-unit demand bidder's bidding behavior differs from multi-unit demand bidder's. We develop an empirical model to estimate those issues using the overlapping online auction data.

■ TA63

63- Borein B- Hyatt

Decision Making in Operational Contexts

Sponsor: Behavioral Operations

Sponsored Session

Chair: Enno Siemsen, University of Minnesota, 321 19th Ave. S, Minneapolis, MN, United States of America, siems017@umn.edu

1 - Wholesale Pricing under Fairness Concerns

Julie Niederhoff, Syracuse University, Syracuse, NY, United States of America, jniederh@syr.edu, Panos Kouvelis

Modeling analysis shows that, under fairness-based utility functions, the uncoordinated system is maximized if the supplier is generously fair-minded while the retailer is spiteful. Through a series of controlled experiments we consider these analytical predictions to study how suppliers set wholesale prices and how retailers set inventory levels in a newsvendor setting.

2 - Decision Bias in the Sequential Search for the Best Alternative: A Laboratory Investigation

David Hall, PhD Candidate, Clemson University, 113 Daniel Ave., Seneca, SC, 29678, United States of America, dchall@clemson.edu, Gulru Ozkan

How to optimally and sequentially search for the best alternative has been examined extensively in the extant New Product Development literature. The optimal search policy is to develop products with the highest net present value, often requiring radical innovation. Yet to the contrary, anecdotal evidence suggests that incremental innovation may be preferred. With this in mind, we ask: Do agent's decision biases cause them to develop incremental products at the expense of radical products?

3 - The Anatomy of Newsvendor Order Decisions: Results from a Task Decomposition Experiment

Yun Shin Lee, Judge Business School, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Enno Siemsen

We study the anatomy of a newsvendor order decision by decomposing it into point forecast, distribution forecast and service level decision and take a systematic approach to predict actual order behavior using these components. We also test whether we can improve order decisions by forcing decision makers to recognize the decomposed components.

4 - Decision Making and Cognition in Multi-Echelon Supply Chains: An Experimental Study

Brent Moritz, Assistant Professor, Pennsylvania State University, 469 Business Building, University Park, PA, 16802, United States of America, bmoritz@psu.edu, Arunchalam Narayanan

Supply chain performance often depends on the decisions of channel members. Using a variant of the Beer Game, we find that the cognitive profile of the decision maker has an impact on performance, both for the supply chain and for a particular echelon. The effect is more pronounced in more complex problem environments. The findings have implications for supply chain design, education and industry employers.

■ TA66

66- Ellis West- Hyatt

Data Driven Analytics in Support of Equipment Health Management

Sponsor: Data Mining

Sponsored Session

Chair: Artur Dubrawski, Director, Auton Lab, Carnegie Mellon University, 5000 Forbes Avenue NSH 3121, Pittsburgh, PA, United States of America, awd@cs.cmu.edu

1 - Data Overload: V-22 Osprey's Foray into Big Data
Joseph Schmidley, V-22 ALE IPT Lead, Department of the Navy, 47123 Buse Road, B2272 Rm 146, Patuxent River, MD, 20670, United States of America, joseph.schmidley@navy.mil

After 100,000 flight hours, the V-22 program has started to leverage mass amounts of data from this sensor-rich tiltrotor platform. The requirement to collect/process/analyze aircraft data, with an increase in operational tempo, while continuing to grow in fleet size, the V-22 program must take action to capitalize on all of its data. We will review the V-22's current challenges and the collaborative efforts through its transition from information technology to information capital.

2 - Detection of Anomalous Maintenance Patterns in Support of Management of an Aviation Fleet
Norman Sondheimer, University of Massachusetts, Amherst, MA, United States of America, sondheimer@cs.umass.edu, Artur Dubrawski

Multivariate time series analysis of maintenance records to determine unusual patterns of behavior has been found effective in providing early warning of systematic failures of components. This presentation shows how these techniques were integrated into the management of aircraft fleets. The results can be generalized to fleets of other types of equipment.

3 - P-MATCH and QUBIT: Methods to Extract Critical Information in Free Text for System Health Management
Anne Kao, Technical Fellow, Boeing, P.O. Box 3707, MC 7L-43, Seattle, WA, 98124, United States of America, anne.kao@boeing.com, Stephen Poteet, David Augustine

In data sources for system health management, free text data often provides critical information. Analysts need to extract detailed information with high recall from very noisy text data. We will use airplane health management to illustrate how to extract critical information from free text data and better support decision making in system health management. Our methods use text analytics and visual interactive techniques to leverage analysts' knowledge to improve system health management.

4 - Intelligent Maintenance Decision Support Tool
Oscar Kipersztok, Technical Fellow, Boeing Research & Technology, P.O. Box 3707, MC 7L-44, Seattle, WA, 98124, United States of America, oscar.kipersztok@boeing.com

A decision support tool is presented to facilitate quick turn around at airplane maintenance and dispatch facilities. It is used for fault isolation and diagnosis. Its inputs are failure indication and its outputs are lists of probable causes and recommended maintenance actions. It is based on knowledge from troubleshooting and fault isolation manuals, and reliability data. It is aimed at reducing diagnosis errors and unnecessary component replacements to reduce operating costs.

■ TA67

67- Ellis East- Hyatt

Nanomanufacturing and Nanoinformatics I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qiang Huang, Associate Professor, University of Southern California, 3715 McClintock Avenue, GER240, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Lijuan Xu, University of Southern California, 3715 McClintock Ave., GER 236, Los Angeles, CA, 90089, United States of America, lijuanxu@usc.edu

1 - Cross-Domain Model Building and Validation to Reinforce Understanding of Nanowire Weight Kinetics
Li Wang, University of Southern California, 3715 McClintock Ave., RM 236, Los Angeles, CA, 90089, United States of America, Wang40@usc.edu, Qiang Huang

Understanding nanostructure growth faces issues of limited data, lack of physical knowledge, and large process uncertainties. These issues result in modeling difficulty because a large pool of candidate models almost fit the data equally well. In this talk, we present a new cross-domain model building and validation approach to address these challenges for scalable nanomanufacturing.

2 - Causal Inference for Scale-up in Nano-manufacturing
Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, 02138-2901, United States of America, dasgupta@stat.harvard.edu, Qiang Huang

Statistical inference for nanostructure growth models is typically drawn from small scale laboratory-level experiments. To scale up nanostructure growth, it is necessary to expand the scope of inference to super-populations which mimic actual manufacturing conditions. A framework for causal inference, based on potential outcomes, can provide a solution to this challenging problem.

3 - A Two-stage Statistical Approach to Modeling the Potential Surface in Nanoquantification
Peter Qian, University of Wisconsin, Madison, WI, United States of America, peterq@stat.wisc.edu

Quantifying the potential from nanomaterial under AFM scanning is challenged by the massive and complicated topography. A physical model is difficult to fully capture the relations between potential and topography. In this work, we propose a two-stage statistical approach to build the link between potential and topography and then explore the spatial dependence of the potential surface. Better prediction performance of the new approach can be demonstrated by numerical study.

4 - Graphene Growth Process Modeling
Jian Wu, USC ISE, 3715 McClintock Avenue, GER 236, Los Angeles, CA 90089-0193, United States of America, wujian@usc.edu, Qiang Huang

Graphene growth on Cu foils shows four-lobed-symmetric shape and angle dependent growth velocity. We decompose the growth process and develop a modeling approach to describe the area coverage and geometric shape of graphene islands.

■ TA68

68- Suite 312- Hyatt

Simulation Techniques in Financial Risk Management

Sponsor: Financial Services Section

Sponsored Session

Chair: Wei Chen, Principal Product Manager, SAS Institute Inc., SAS Campus Dr., Cary, NC, 27512, United States of America, Wei.Chen@sas.com

1 - A Hybrid Simulation Methodology to Simulate Financial Risks
Jack Yang, Senior Research Statistician, SAS Institute, Inc, 100 SAS Campus Dr, Cary, NC, United States of America, Jack.Yang@sas.com

This paper introduces a simulation method that allows a combination of different simulation techniques in one simulation.It is especially suitable for a large financial system where each sub-group of risk factors can be simulated by using different data source and special modeling methods. The hybrid simulation technique accommodates all sub-models into a system and use copula to support the correlation structure.

2 - Efficient Monte Carlo Simulation in Counterparty Credit Risk Measurement
Samim Ghamami, University of Southern California, Los Angeles, CA, United States of America, ghamami@usc.edu, Bo Zhang

Counterparty credit risk measurement requires extensive use of Monte Carlo simulation. We analyze and comment on recent Monte Carlo counterparty credit risk methodologies being employed by financial institutions. We, also, develop an efficient Monte Carlo framework for estimation of average-type counterparty credit risk measures.

3 - A Dynamic Simulation Approach to Financial Risk Analysis
Sunny Zhang, Senior Risk Consultant, SAS, 100 SAS Campus Dr., Cary, NC, 27513, United States of America, Sunny.Zhang@sas.com, Wei Chen, Jack Yang

We present a dynamic simulation approach with forward-looking assessment of market states. This new approach allows to control and select different simulation regimes and forecasting horizons as well as models based on the attributes of risk factors and portfolios. This approach can better forecast market states and capture extreme events so to improve various risk measures for VAR, stress testing and liquidity risk management, and assessment of economic capital across the entire enterprise.

■ TA69

69- Suite 314- Hyatt

Optimization in Finance

Cluster: Optimization in Finance

Invited Session

Chair: Luis Zuluaga, Assistant Professor, Lehigh Univeristy, 200 West Packer Ave., Bethlehem, United States of America, luis.zuluaga@lehigh.edu

1 - Stock Return Serial Dependence and Out-of-Sample Portfolio Performance

Victor DeMiguel, Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, avmiguel@london.edu, Raman Uppal, Francisco J. Nogales

We study whether investors can exploit stock return serial dependence to improve portfolio performance. First, we show that a vector autoregressive (VAR) model captures daily stock return serial dependence in a statistically significant manner. Second, we show that both arbitrage (zero-cost) portfolios and investment (positive-cost) portfolios that exploit serial dependence in stock returns outperform the traditional portfolios, even in the presence of transaction costs of up to 10 basis points.

2 - Tractable Asset-Liability Management under Time-Varying Investment Opportunities

Dessislava Pachamanova, Associate Professor, Babson College, Babson Park, MA, United States of America, dpachamanova@babson.edu

We present models for asset liability management that are applicable to the management of pension funds and to the pricing of some kinds of structured financial products. The emphasis of the proposed approaches is on computational tractability and practical appeal. Numerical studies with real market data indicate that the proposed strategies have better worst-case performance than traditional stochastic approaches, as well as other desirable characteristics.

3 - Bounds on the Expected Payments of Insurance Instruments: A Novel Computational Approach

Robert Howley, Lehigh University, 200 West Packer Avenue, Harold S Mohler Lab, Bethlehem, PA, 18015-1582, roh210@lehigh.edu, Luis Zuluaga, Robert Storer

It has been shown that single random variable semiparametric bounds can be solved using semidefinite programming (SDP). While the SDP approach was the foundation of many important advances in the literature, it has practical limitations. Here, we develop a method that uses standard optimization techniques, such as linear and first-order nonlinear programming. We also show that our approach allows the inclusion of extra information about the random variable (e.g., unimodality) in a simple way.

■ TA70

70- Suite 316- Hyatt

Interactive Advertising

Sponsor: Information Systems

Sponsored Session

Chair: Vibhanshu Abhishek, University of Pennsylvania, Phildelphia, PA, United States of America, vabhi@wharton.upenn.edu

1 - Online Advertising Response Models with Multiple Creatives and Impression Histories

Michael Braun, Associate Professor of Marketing, Massachusetts Institute of Technology, Sloan School of Management, 100 Main St., E62-535, Cambridge, MA, 02139, United States of America, braunm@mit.edu, Wendy Moe

Online advertising campaigns can consist of multiple ads with different creative content. We propose a model that evaluates the impact of each ad impression on both visitation and conversion behavior. Our model allows for the accumulation, decay, wearout and restoration of advertising effects. We show that online advertisers can increase the number of website visits and conversions by varying the creative content shown to an individual, according to that individual's impression history.

2 - Information Asymmetry and Hybrid Advertising

De Liu, Associate Professor, Gatton College of Business and Economics, University of Kentucky, Lexington, KY, United States of America, de.liu@uky.edu, Siva Viswanathan

Pay-for-performance (P4P) advertising schemes such as pay-per-click have grown in popularity. Meanwhile the traditional pay-per-impression (PPI) scheme persists, and advertising providers start to offer a hybrid mix of PPI and P4P schemes. We examine optimal pricing schemes and demonstrate a trade-off between using P4P schemes to reveal superior quality and using PPI to minimize allocative inefficiencies. We shed light on several provider strategies, including increasing use of hybrid schemes.

3 - Bid Jamming

Shijie Lu, University of Southern California, 3660 Trousdale Parkway, ACC 306, Marshall School of Business, Los Angeles, CA, 90089, United States of America, shijielu@usc.edu, Yi Zhu

Bid jamming is a practice in Generalized Second-Price (GSP) auctions that allows an advertiser at a lower position to bid one cent less than her competitor to accelerate the depletion of the competitor's budget. This paper examines the impact of bid jamming on publisher's revenue. The overall impact is found to be indefinite and is positively correlated with the competition intensity of the GSP auction. Several important managerial implications for both publishers and advertisers are discussed.

■ TA71

71- Suite 318- Hyatt

Improving Corporate Information Security through Policy, Monitoring and Tools

Sponsor: eBusiness

Sponsored Session

Chair: Sam Ransbotham, Boston College, 140 Commonwealth Ave, Chestnut Hill, MA, 02467, United States of America, sam.ransbotham@bc.edu

1 - Is Corporate Social Responsibility Good for IS Security?

John D'Arcy, University of Delaware, Newark, DE, United States of America, jdarcy@udel.edu

Using a combined dataset of security breaches (2005-2010) and ratings on over 30 different dimensions of corporate social responsibility (CSR), we explore the relationship between CSR and IS security breaches. Drawing on signaling theory, we hypothesize that internal breaches are less likely as CSR practices increase. However, we also predict a positive relationship between CSR and external breaches. Contingency factors that influence these relationships will be discussed.

2 - How Does Continuous Auditing and Monitoring Impact Employees' Intentions to Commit Fraud?

France Bèlanger, Professor, Virginia Tech, 3007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, belanger@vt.edu, Kathy Enget

Employee fraud has a potentially broad impact. Continuous auditing and monitoring (CA/CM) can be a valuable tool in this situation. This research explores CA/CM impacts on the fraud triangle via interviews and then with a vignette-based survey. The proposed vignettes focus on a manager needing to meet sales targets. With CA/CM, we expect to find lower intentions to commit fraud, lower perceived opportunities, no change in perceived pressures, and no change or lower ability to justify fraud.

3 - Impact of Anti-phishing Tool Performance on Attack Success Rates

Ahmed Abbasi, University of Virginia, Rouss and Robertson Halls, Charlottesville, VA, United States of America, abbasi@comm.virginia.edu, Mariam Zahedi, Yan Chen

Phishing website-based attacks continue to present significant problems for individual and enterprise-level security. While the performance of anti-phishing tools has improved, it remains unclear how effective such tools really are at protecting users. In this study, an experiment involving over 900 participants was used to evaluate the impact of anti-phishing tool performance on users' ability to avoid different types of phishing threats.

■ TA72

72- Suite 322- Hyatt

Computational Stochastic Optimization in Energy I

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Cosmin Petra, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, Il, 60439, United States of America, petra@mcs.anl.gov

1 - Approximate Dynamic Programming for the Stochastic Control of a Wind Energy Storage System

Daniel Salas, Princeton University, 228 Sherrerd Hall, Princeton, NJ, 08540, United States of America, dsalas@princeton.edu, Warren Powell

One of the main challenges in developing wind energy storage strategies is to maximize the allocation efficiency of the storage devices, which may be charged or discharged at each point in time. These devices are generally treated as simple black-box models which do not explicitly reflect the underlying physicochemical principles. ADP is proposed as a way to obtain a practical control policy for a more realistic battery system, by taking into account the uncertainty in supply and demand.

2 - Optimal Scheduling of Critical Peak Pricing Events with Day-ahead Wind Energy Commitments

Xiaoxuan Zhang, IBM TJ Watson Research, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, zhangxia@us.ibm.com, Bo Zhang

We investigate the optimal scheduling of critical peak pricing from the perspective of a load serving entity who has wind energy to commit. The goal is to minimize the total cost for the whole planning horizon, including energy purchasing cost, revenue from the critical peak pricing, wind sales, and imbalance penalties due to wind over- and under-commitments. We propose a multi-stage stochastic mixed integer nonlinear programming model and present an optimal stopping view of this model.

3 - Emulating Stochastic Programming Effects in the Unit Commitment Problem

Boris Defourny, Princeton University, ORFE, Sherrerd Hall, Charlton St., Princeton, NJ, 08544, United States of America, defourny@princeton.edu, Hugo Simao, Warren Powell

We study modifications of the deterministic unit commitment problem for emulating the behavior of a multistage stochastic model without optimizing over multiple scenarios. To do that we distort the forecasted demand and wind energy seen by the unit commitment model, and we introduce optimization variables and constraints for representing special kinds of reserve requirements, tuned by simulation or by solving auxiliary stochastic programs.

4 - Stochastic Optimization of Power Grid on High-performance Computers

Cosmin Petra, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, Il, 60439, United States of America, petra@mcs.anl.gov, Mihai Anitescu, Miles Lubin

We present a scalable framework for solving stochastic programming problems, with application to the optimization of power grid energy systems with uncertain supply and demand. Our framework, PIPS, has parallel capabilities for both continuous and discrete stochastic optimizations problems. We will also discuss the computational results obtained on "Intrepid" Blue Gene/P system at Argonne when solving unit commitment problems with billions of variables.

■ TA73

73- Suite 324- Hyatt

Topics on American Options

Cluster: Quantitative Finance

Invited Session

Chair: Daniel Mitchell, University of Texas, McCombs School of Business, 1 University Station, B6000, Austin, TX, 78712, United States of America, Daniel.Mitchell@phd.mccombs.utexas.edu

1 - Boundary Evolution Equations for American Options

Daniel Mitchell, University of Texas, McCombs School of Business, 1 University Station, B6000, Austin, TX, 78712, United States of America, Daniel.Mitchell@phd.mccombs.utexas.edu, Kumar Muthuraman, Jonathan Goodman

We consider the problem of finding optimal exercise policies for American options in constant and stochastic volatility. We derive and use boundary evolution equations that characterize the evolution of the optimal exercise boundary. Using these boundary evolution equations we show how one can construct very efficient computational methods for pricing American options.

2 - American Option Pricing for Subordinate Diffusions

Lingfei Li, Assistant Professor, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong-PRC, lingfeili2012@u.northwestern.edu, Vadim Linetsky

We develop an eigenfunction expansion approach for pricing American options under models based on subordinate diffusions (i.e. jump-diffusions or pure jump processes obtained by time changing diffusions with Levy subordinators). As an application we consider American option pricing under the SubOU-based commodity model with mean-reverting jumps.

3 - Pricing and Static Hedging of American Options under the Jump to Default Extended CEV Model

Jose Carlos Dias, ISCTE-IUL Business School, Complexo INDEG/ISCTE, Av. Prof. Anibal Bettencourt, Lisboa, Portugal, jose.carlos.dias@iscte.pt, Joao Pedro Ruas, Joao Pedro Nunes

This paper prices American options through the static hedge approach (SHP) and extends the literature in two directions. First, American options are priced under the CEV model of Cox (1975) through the SHP procedure offered by Chung and Shih (2009), but now extended for any elasticity parameter (beta) of the CEV process. Second, the SHP approach is adapted to the JDCEV model of Carr and Linetsky (2006), and American options on defaultable equity are also priced.

Tuesday, 11:00am - 12:30pm

■ TB01

01- West 101- CC

Nonlinear Integer Optimization and Applications

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Serdar Karademir, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, United States of America, sek73@pitt.edu

1 - Irregular Polyomino Tilings via Integer Programming

Serdar Karademir, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, United States of America, sek73@pitt.edu, Oleg Prokopyev

Polyominoes are created by connecting unit squares along an edge. Recently, irregular polyomino tilings have been used in the design of array antennas to improve their imaging capabilities. We formulate the problem as a nonlinear exact set covering model where irregularity is measured using the information theoretic entropy concept. A column generation approach along with novel branching and lower bounding schemes is proposed. We also provide efficient heuristics and approximation algorithms.

2 - On a Class of Nonlinear Bilevel Knapsack Problems

Behdad Beheshti, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, bek42@pitt.edu, Oleg Prokopyev, Osman Ozaltin

We study a bilevel knapsack problem where the leader's objective is in a nonlinear form. We discuss related theoretical computational complexity issues. We also present an exact enumeration approach based on a specialized branch-and-backtrack algorithm. The performance of the proposed approach is evaluated on a large number of instances.

3 - Improving the Quality of the Assignment of Students to First-Year Seminars

Richard Forrester, Associate Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States of America, forrestr@dickinson.edu, Kevin Hutson, Thanh To

Many institutions of higher education have a First-Year Seminar Program. At Dickinson College, students are required to select six seminars from a list of 42 possibilities. Using standard optimization software, we assign students to seminars so as to balance both the gender and number of international students in the seminars. In addition, we use Monte Carlo simulation to study how the number of seminars each student is required to select affects the likelihood that a feasible assignment exists.

4 - Nonlinear Mixed Integer Programming in Power Network Optimization

Pavlo Krokhmal, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, krokhmal@engineering.uiowa.edu, Bo Sun

We consider the problem of optimizing power load distribution in networks, which reduces to non-linear mixed integer second order cone programming model. An algorithm based on cutting plane method for solving polyhedral approximations of the relaxed problem is proposed. Numerical case studies are presented.

■ TB02

02- West 102 A- CC

Advice Taking and Opinion Aggregation

Sponsor: Decision Analysis

Sponsored Session

Chair: Jack Soll, Associate Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, jsoll@duke.edu

1 - Combining the Intuitive and Analytic Mind

Jack Soll, Associate Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, jsoll@duke.edu, Rick Larrick

We show the benefits of having the same individual make a rapid intuitive judgment and a slower deliberate judgment, and then averaging them. There is an asymmetry, however, such that the intuitive-analytic sequence allows for greater "refreshing" and bracketing than the reverse sequence. Similar benefits occur when combining strategies across people. We discuss the implications for debiasing strategies.

2 - Double-sided Utility Copulas

Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

A double-sided utility copula matches the conditional utility assessments at all boundary values of the domain of the attributes and allows for an additional degree of freedom to vary the trade-off assessments among them. We should how to construct such utility copula functions and discuss methods for their assessment.

3 - The Wisdom of Small Crowds of Probability Forecasters

Yael Grushka-Cockayne, Assistant Professor, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu, Albert Mannes, Casey Lichtendahl

Recent evidence suggests that the accuracy of the average point forecast increases rapidly in crowd size initially and then slowly thereafter. We study this effect in the context of probability forecasting. We find that the accuracy of the average probability forecast increases up to a certain crowd size and then decreases thereafter.

■ TB03

03- West 102 B- CC

Games, Decisions, and Descriptive Models Beyond Rationality

Sponsor: Decision Analysis

Sponsored Session

Chair: Seth Guikema, Assistant Professor, Johns Hopkins University, 313 Ames Hall, Department of Geog & Env. Engineering, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu

1 - Beyond Rationality: Some Examples of Descriptive Models of Behavior in Decision Settings

Seth Guikema, Assistant Professor, Johns Hopkins University, 313 Ames Hall, Department of Geog & Env. Engineering, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu

Decisions must be made in the presence of other intelligent actors in many settings such as terrorist risk management and environmental regulation and enforcement. Model are often used to describe the actions of these other players, and there is an increasing interest in behavioral models of these other players. This talk gives an overview of recent work in this area and sets the stage for the three research talks in the session.

2 - The Matching Law: Application of a Psychological Model to a Management Problem

Philip Leclerc, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23284, United States of America, leclercpd@vcu.edu, Laura McLay, Jason Merrick

Many optimization models require that human behavior be modeled. We introduce Herrnstein's Matching Law, a model of choice behavior developed in operant psychology. We explore a class of non-convex optimization problems created by introducing the Matching Law into a preexisting optimization problem, and demonstrate how to approximately solve a particular class of such problems using separable programming. We apply our method to an assignment problem.

3 - Rationality Bias in Water Resource Management

Stefanie M. Falconi, PhD Student, Johns Hopkins University, 3400 N. Charles St., Ames 313, Baltimore, MD, 21218, United States of America, stefanie.falconi@jhu.edu

In the water resource management field the rationality axioms have been central to systems analysis models. Empirical studies of water management in real political context point to the oversimplifications of these assumptions. What is the implication of this bias and why does it pose challenges to how water gets managed? This talk will explore several case studies to highlight the inconsistencies between the rationality axioms and the objectives of integrative water resource management.

4 - Agent-based Simulation of Learning Adversaries in Defender-attacker Games

Emily Zechman, Assistant Professor, North Carolina State University, CB 7908, Raleigh, NC, 27695, United States of America, emzechma@ncsu.edu, Seth Guikema

Advanced analytical methods typically model defender-attacker games by assuming a static decision-making process for players. Over a series of plays and pay-offs, however, both defenders and attackers may adapt their decision-making strategy and their assumptions about the adversary's decision-making strategy. This research couples agent-based modeling with game theory to simulate the evolution of a game and pay-offs as players learn.

■ TB04

04- West 102 C- CC

Data Envelopment Analysis II

Cluster: Data Envelopment Analysis

Invited Session

Chair: Joe Zhu, Professor, Worcester Polytechnic Institute, 100 Institute Rd, Worcester, MA, 01609, United States of America, jzhu@WPI.EDU

1 - Improving DEA Efficiency under Multiple Perspectives by Game Theory

Xiaopeng Yang, University of Toronto, Centre for Management of Technology, Toronto, Canada, xiaopeng.yang@utoronto.ca, Joseph Paradi, Hiroshi Morita

In the current research, each perspective stands for a classification of input/output for the attributes of DMU. Different perspectives have distinctive preferences even for the same attribute of DMU. In order to improve the DEA efficiency of a DMU under such a conflictive circumstance, we propose a new calculation method using game theory. A numerical case study of banking systems is also given to show the calculation results of our approach.

2 - Use of DEA Cross-efficiency Evaluation in Portfolio Selection

Sungmook Lim, Associate Professor, Korea University, Jochiwon-eup, Yeongi-gun, Chungnam, 339700, Korea, Republic of, sungmook@korea.ac.kr, Joe Zhu

We propose a novel use of DEA cross-efficiency evaluation in portfolio selection. In addition to average cross-efficiency scores, we suggest to examine the variations of cross-efficiencies, and to incorporate the two statistics of cross-efficiencies into the mean-variance formulation of portfolio selection. Two benefits can be attained by this approach; selection of robust portfolios and alleviation of the so-called "ganging together" phenomenon of DEA cross-efficiency evaluation.

3 - Network DEA Pitfalls

Joe Zhu, Professor, Worcester Polytechnic Institute, 100 Institute Rd, Worcester, MA, 01609, United States of America, jzhu@WPI.EDU, Yao Chen, Wade Cook, Chiang Kao

Network DEA models been developed to examine the efficiency DMUs with internal structures. Pitfalls in network DEA are discussed with respect to the determination of divisional efficiency, frontier type, and projections.

■ TB05

05- West 103 A- CC

Decision Analysis Approaches and Predictive Modeling to Managing Uncertainty in Manufacturing and Service Systems Design & Operations

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu

Co-Chair: Martin Wortman, Professor, Texas A&M University, wortman@tamu.edu

1 - Modeling and Prediction of Degradation Profiles in Tissue-engineered Scaffold Fabrication

Li Zeng, Assistant Professor, The University of Texas at Arlington, 500 West First Street, Arlington, TX, 76019, United States of America, lzeng@uta.edu, Xinwei Deng

Tissue-engineered scaffolds is an important bio-manufacturing products, which plays a critical role in the development of engineered tissues/organs. One important quality characteristic of tissue-engineered scaffolds is their degradation profile in human bodies. This study builds statistical models for the degradation profiles and considers predicting degradation of scaffolds under given experimental settings based on the model.

2 - Chemical Mechanical Planarization (CMP) Process Monitoring using Evolutionary Clustering Analysis

Omer Beyca, Research Assistant, Oklahoma State University, Stillwater, OK, 74074, United States of America, beyca@ostatemail.okstate.edu, Zhenyu (James) Kong, Satish Bukkapatnam

Process monitoring for Chemical Mechanical Planarization (CMP) is extremely crucial to detect process defects and ensure high quality of polished wafers in semiconductor industry. It is challenging due to the non-linear and non-stationary nature. We proposed a novel Recurrent Nested Dirichlet Process (RNDP) model to tackle this challenge by dynamically constructing mixture of Gaussian distributions in a Markovian manner. Our case studies demonstrated the effectiveness of the proposed method.

■ TB06

06- West 103 B- CC

Monte Carlo Methods in Finance

Sponsor: Simulation

Sponsored Session

Chair: Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@illinois.edu

1 - American Option Sensitivities Estimation via a Generalized IPA Approach

Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, Hong Kong-PRC, nchen@se.cuhk.edu.hk, Yanchu Liu

We develop efficient Monte Carlo methods for estimating American option sensitivities. A generalized infinitesimal perturbation analysis (IPA) approach introduced to resolve the difficulty caused by discontinuity of the optimal decision with respect to the underlying parameter. In contrast to the conventional IPA method, we find that the pathwise differentiability is not necessary for the application of our generalized IPA. Numerical implementation and error analysis are also discussed.

2 - Denoising Monte Carlo Sensitivity Estimates

Kyoung-Kuk Kim, Assistant Professor, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, catenoid@kaist.edu, Wanmo Kang, Hayong Shin

Monte Carlo methods are popular in academia and industry. We are interested in improving sensitivity estimates obtained from MC experiments with respect to given parameter values, motivated by, but not restricted to, financial applications. Denoising and interpolation methods, which have been used for a long time in many different areas, are proposed in a new form which is quadratic, easy to implement, and tailored to our objectives. This heuristic approach is supported by numerical experiments.

3 - Simulation-based Maximum Likelihood Estimation for Levy-driven OU Stochastic Volatility Models

JianQiang Hu, Professor, Fudan University, Department of Management Science, Shanghai, 200433, China, hujq@fudan.edu.cn, Yijie Peng, Michael Fu

We study the problem of estimating parameters for Levy-Driven Ornstein-Uhlenbeck stochastic volatility models, which has a wide range of applications in finance, econometrics, and statistics. We consider the problem in the framework of maximum likelihood estimation and use various techniques in simulation optimization, including conditional Monte Carlo sensitivity estimation and sequential Monte Carlo method for hidden Markov processes. We present numerical results to validate out method.

4 - Simulating from Analytic Characteristic Functions

Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S Mathews Ave., Urbana, IL, 61801, United States of America, fenglm@illinois.edu, Zisheng Chen

Analytic characteristic functions naturally arise in financial engineering applications. We explore the analyticity of such characteristic functions and propose simple but accurate inversion schemes. They admit explicit error estimates that allow us to derive explicit bounds for the estimation bias when the inverse transform method is used to simulate from such analytic characteristic functions.

■ TB07

07- West 104 A- CC

Data Mining in Medical Decision Making and Bioinformatics Applications

Sponsor: Data Mining

Sponsored Session

Chair: Kamran Paynabar, University of Michigan, Ann Arbor, MI, United States of America, kamip@umich.edu

1 - Bayesian Analysis of Multiway Table of Genetic Effects: A Model Comparison Approach

Xiaoquan Wen, University of Michigan, 1415 Washington Heights Road, Ann Arbor, MI, 48109, xwen@umich.edu

We consider the inference problem on unobserved quantities that can be represented by multiway tables. We focus on Bayesian model comparisons in complex linear systems, in which we show multiway tables are naturally formed by regression coefficients. We specify prior distributions to enable efficient information sharing across and within different dimensions of multiway tables. Analytic results of Bayes Factors and their approximations are derived and their various properties are discussed.

2 - Supervised Link Prediction in Biological Networks using Penalized, Multi-Mode ERGMs

Ali Shojaie, University of Washington, F650 Health Sciences Bldg, Department of Biostatisitcs, Seattle, WA, 98109, United States of America, ashojaie@u.washington.edu

Available methods for inferring biological networks often focus on a single type of interaction among genes, which can results in incomplete information and high false positive rates. To address this limitation, we propose a multi-mode network model, based on exponential random graph models (ERGM), which represents different types of interactions, and provides a natural method of estimating networks based on known interactions and diverse sources of biological data.

3 - Self-organized Signal Quality Control in Cardiorespiratory Monitoring

Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

Telemedicine is critical to ensure the timely delivery of health care to patients, especially those who live in the rural areas. However, there are a number of uncertainty factors inherent to the telehealthcare, for e.g., the personnel with minimal training. This paper presents our efforts to integrate multiscale recurrence analysis with self-organizing map for controlling the signal quality. The efficacy and robustness of this approach are validated using real-world telemedicine recordings.

4 - Decision Making about Surgical Treatment for Rotator Cuff Tear Patients Based on Patients' Clinical

Kamran Paynabar, University of Michigan, Ann Arbor, MI, United States of America, kamip@umich.edu, Bruce Miller, Richard Hughes, Judy Jin

Treatment of patients with rotator cuff tears usually starts with a period of physical therapy. Patients who fail to respond to physical therapy are treated surgically. Identifying such patients, in initial clinical examination would help reduce the time and costs of treatment by skipping physical therapy. The goal of this study is to develop a regularized classification model for predicting the necessity of surgery based on the results of a patient's clinical examination.

■ TB08

08- West 104 B- CC

Joint Session PPSN/HAS: Optimization in Health Policy

Sponsor: Public Programs, Service and Needs & Health Applications Society

Sponsored Session

Chair: David Hutton, University of Michigan, 1415 Washington Heights, SPH II: M3525, Ann Arbor, MI, 48109, United States of America, dwhutton@umich.edu

1 - Pricing Strategies for Combination Pediatric Vaccines Based on the Lowest Overall Cost Formulary

Banafsheh Behzad, PhD Candidate, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, behzad1@illinois.edu, Sheldon Jacobson, Edward Sewell

This paper analyzes pricing strategies for pediatric combination vaccines by comparing the lowest overall cost formularies for a fixed cost of injection. Three pharmaceutical companies compete over the sale of pediatric vaccines. The main contribution of the paper is to provide the lowest overall cost formularies for a fixed cost of an injection for different prices of Pentacel. The resulting analysis shows that Pentacel could have been more competitively priced compared to the Pediarix.

2 - The Balance Optimization Subset Selection (BOSS) Model for Causal Inference

Jason Sauppe, University of Illinois, Dept. of CS, Urbana, IL, United States of America, sauppe1@illinois.edu, Sheldon Jacobson, Edward Sewell, Alexander Nikolaev

Scientists in many fields rely on observational (non-random) data to estimate the effects of a treatment. To control for potential sources of bias in the estimate, a matching procedure is used. The success of the matching process is assessed using a balance measure. The Balance Optimization Subset Selection model eliminates the matching step and optimizes the balance measure directly. This has the potential to lead to more informed decisions about treatment effectiveness.

3 - Strategic Health Care Workforce Management

Alejandro Toriello, Assistant Professor, Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave., GER 240, Los Angeles, CA, 90089, United States of America, toriello@usc.edu, Mariel Lavieri

We propose a long-term workforce management model for a large health care system with arbitrary deterministic non-decreasing demand, using infinite linear programming. The model monitors hiring, training and promotion of a type of health care worker across the entire system. We provide a series of conditions the system can satisfy to ensure that one-period lookahead policies are optimal. We also give a sensitivity analysis of the cost impact of various system parameters, such as demand.

4 - Using Antivirals for Prevention or Treatment During an Influenza Pandemic

Benjamin Armbruster, Assistant Professor, Northwestern University, Evanston, IL, 60208, United States of America, armbruster@northwestern.edu, David Hutton

Many countries are stockpiling antivirals for prevention and treatment of pandemic influenza. We analyze an infectious disease model to determine the optimal allocation of the stockpile between prevention and treatment. We characterize the optimal solution analytically. Allocating current national antiviral stockpiles to treatment are likely to minimize population mortality. But, with much larger stockpiles, using antivirals for prevention may be optimal.

■ TB09

09- West 105 A- CC

A History of Multiple Criteria Decision Making

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Stanley Zionts, Distinguished Professor Emeritus, School of Management, State University of New York, Buffalo, NY, 14260, United States of America, szionts@buffalo.edu

1 - A History of Multiple Criteria Decision Making

Stanley Zionts, Distinguished Professor Emeritus, School of Management, State University of New York, Buffalo, NY, 14260, United States of America, szionts@buffalo.edu

This presentation is based on a book, Multiple Criteria Decision Making: From Early History to the 21st Century, published by World Scientific, Singapore, 2011 authored by Murat Köksalan, Jyrki Wallenius, and myself. It covers multiple criteria decision making and related developments from the earliest known works to work of the twentieth century.

■ TB10

10- West 105 B- CC

Joint Session OPT/ENRE: Stochastic Programming and Power System Optimization

Sponsor: Optimization/Stochastic Programming & Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Yongpei Guan, Associate Professor, University of Florida, Department of Industrial and Systems, Engineering 303 Weil Hall, Gainesville, FL, 32608, United States of America, guan@ise.ufl.edu

1 - Multi-area Optimal Power Flow with Reconfigurable Transmission Network

Cong Liu, Computational Engineer-Energy Systems, Argonne National Laboratory, 9700 South Cass Ave., Building 221, Argonne, IL, 60439, United States of America, liuc@anl.gov, Jianhui Wang

The model separates the whole network into sub-networks by graph partition. Lagrangian multipliers and quadratic penalty terms will be introduced to relax the boundary power flow variables of tie-lines between two adjacent areas. Then the dual problem of the original problem will be decomposed into several sub-problems associated with each area. The program can stop once the gap between the upper and lower bounds satisfies a small predefined value.

2 - Two-stage Robust Optimization for N-k Contingency-constrained Unit Commitment

Qianfan Wang, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, qfwang@ufl.edu, Jean-Paul Watson, Yongpei Guan

A two-stage robust optimization approach is presented to solve the general N-k contingency-constrained unit commitment (CCUC) problem. Both generator and transmission line contingencies are considered in this research. We propose a decomposition framework to enable tractable computation. In our algorithm, the master problem makes unit commitment decisions and the subproblem inspects the worst-case contingency scenarios. The computational results verify the effectiveness of the proposed approach.

3 - Cutting Planes for The Multi-stage Stochastic Unit Commitment Problem

Ruiwei Jiang, University of Florida, 411 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, rwjiang@ufl.edu, Jean-Paul Watson, Yongpei Guan, Ming Zhao

Motivated by the intermittency of renewable energy, we propose a multi-stage stochastic integer programming model in this talk to address unit commitment problems under uncertainty, for which we construct several classes of strong inequalities by lifting procedures to strengthen the original formulation. Our preliminary computational experiments show encouraging results.

■ TB11

11- West 105 C- CC

Optimization Algorithms

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Daniel Robinson, Johns Hopkins University, 100 Whitehead Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States of America, daniel.p.robinson@gmail.com

1 - An Adaptive Augmented Lagrangian Method

Daniel Robinson, Johns Hopkins University, 100 Whitehead Hall, 3400 N. Charles Street, Baltimore, MD, 21218, United States of America, daniel.p.robinson@gmail.com, Hao Jiang, Frank Curtis

We present a method for solving constrained optimization problems based on the augmented Lagrangian. In contrast to traditional augmented Lagrangian methods that slowly update multiplier estimates and an associated penalty parameter, our method updates both during each iteration. A strength of our method is the ability to approximately solve each subproblem and to efficiently update the penalty parameter to promote fast local convergence. Preliminary numerical results will be presented.

2 - On the Global Linear Convergence of Alternating Direction Method

Wei Deng, Rice University, 6100 Main St., MS-134, Rice U, CAAM Dept, Houston, TX, 77005, United States of America, wei.deng@rice.edu, Wotao Yin, Yin Zhang

The alternating direction method has proven to be effective for solving many optimization problems, and has wide applications in areas such as compressive sensing, signal and image processing, machine learning, computer vision and statistics. We give sufficient conditions for global linear convergence of the alternating direction method where the iterates are allowed to be computed approximately using proximal methods.

3 - Sparse Approximation via Penalty Decomposition Methods

Zhaosong Lu, Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca, Yong Zhang

We propose penalty decomposition (PD) methods for general l_0 minimization. Under suitable assumptions, we establish that any limit point of the sequence generated by the PD methods satisfies the first-order optimality conditions of the problems. Furthermore, for the problems in which the l_0 part is the only nonconvex part, we show that such a limit point is a local minimizer. Computational results show that our methods generally outperform the existing methods.

■ TB12

12- West 106 A- CC

Joint Session Optimization IP/ICS: Constraint Programming Methodology and Applications I

Sponsor: Optimization/Integer Programming & Computing Society

Sponsored Session

Chair: Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu

1 - Resolution of the Package Server Location Problem

Jean-Charles Regin, Professor, University Nice-Sophia Antipolis, I3S, 2000, Route des Lucioles, Les Algorithmes, Euclide B, BP 121, Sophia Antipolis, 06903, France, Jean-Charles.REGIN@unice.fr, Mohamed Rezgui, Arnaud Malapert, Jean Parpaillon, Yvan Manon

We solve the package server location problem. A number of package servers are to be located at nodes of a network. Demand for services of these servers is located at each node, and a subset of nodes are to be chosen to locate one or more package servers in each. Each customer is associated to a package. The objective is to minimize the number of package servers while maximizing quality of services related to the efficiency and the reliability of the broadcast of packages to all customers.

2 - Retail Scheduling for Profit

Louis-Martin Rousseau, Polytechnique Montréal, CP 6079 Succ. Centre-ville, Montrèal, Canada, louis-martin.rousseau@polymtl.ca, Marc Joliveau, Nicolas Chapados, Pierre L'Ecuyer

We how that shift scheduling can be used to maximize operation profit rather than minimizing cost in retail stores. We evaluate the performance of several MIP models and Constraint Programming models, on both a daily and a weekly horizon.

3 - Joint Assessment and Restoration of Power Systems

Pascal Van Hentenryck, Professor, University of Melbourne, Melbourne, Australia, pvh@nicta.com.au, Carleton Coffrin, Nabeel Gillani

This paper studies the joint damage assessment and recovery of the power infrastructure after a natural disaster has occurred. Earlier work in this area proposed an optimization algorithm for the recovery phase, assuming that the infrastructure damage was known precisely. This paper lifts this assumption and proposes online stochastic optimization approaches that use constraint programming to solve the deterministic problems.

4 - Constraint Restriction in Constraint Satisfaction Problems

Merav Aharoni, IBM Research-Haifa, Haifa University Campus, Haifa, 31905, Israel, MERAV@il.ibm.com, Wesam Ibraheem, Yehuda Naveh, Elena Tsanko

We study the usage of constraint restriction in the process of systematic solving of Constraint Satisfaction Problems. Constraint restriction combines propagation with an arbitrary narrowing of the domains. It can narrow several domains simultaneously, while preserving consistency. We show how to incorporate constraint restriction into a MAC based backtrack search algorithm without compromising the algorithm completeness. We demonstrate several cases where it is useful to apply this technique.

■ TB13

13- West 106 B- CC

Solving Hard Problems in Conic Optimization I

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Akiko Yoshise, University of Tsukuba, 1-1-1 Tennnoudai, Tsukuba, 305-8573, Japan, yoshise@sk.tsukuba.ac.jp

1 - Computation of Facial Reduction

Hayato Waki, Associate Professor, Kyusyu University, 744 Motooka, Nishi-ku, Fukuoka, 819-0395, Japan, Waki@imi.kyushu-u.ac.jp, Masakazu Muramatsu

Facial reduction algorithm (FRA) generates a smaller conic optimization problem by exploiting the degeneracy in a given conic optimization problem. However, the computation is comparable to solving the original problem. In addition, the resulting problem may lose the sparsity. In this talk, we show that one can apply FRA effectively by using structure in the original problem. For this, we present some examples. This is a jointwork with Professor Masakazu Muramatsu (UEC).

2 - Determining Protein Structures by Semidefinite Programming

Nathan Krislock, INRIA Grenoble Rhône-Alpes, 655 Avenue de l'Europe, Montbonnot, Saint-Ismier Cedex, 38334, France, nathan.krislock@inria.fr, Babak Alipanahi, Ali Ghodsi, Henry Wolkowicz, Logan Donaldson, Ming Li

Euclidean distance matrix methods based on semidefinite programming (SDP) are a natural approach for protein structure determination. Our contribution is a new SDP formulation that overcomes the difficulty of the high complexity of SDP solvers by using facial reduction to reduce the problem to approximately one quarter the size of the original problem. The reduced SDP can be solved approximately 100 times faster, and it is more resistant to numerical problems from erroneous and noisy distances.

3 - Numerical Computation of a Facial Reduction Algorithm for Doubly Nonnegative Optimization Problems

Mirai Tanaka, PhD. Student, Tokyo Institute of Technology, 2-12-1-W9-60 Ookayama, Meguro-ku, Tokyo, 152-8552, Japan, tanaka.m.aa@m.titech.ac.jp, Kazuhide Nakata, Hayato Waki

A facial reduction algorithm works for conic optimization problems and generates an equivalent conic optimization problem that has interior feasible solutions in finitely many iterations. This algorithm is great in theory but it has been considered to be difficult use in practice. In this talk, we introduce a numerical computation method of the facial reduction algorithm for doubly nonnegative optimization problems.

■ TB14

14- West 106 C- CC

Practical Batching and Supply Chain Scheduling Problems

Cluster: Scheduling and Project Management

Invited Session

Chair: Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu

1 - Integrated Charge Batching and Casting Width Selection at Baosteel

Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu, Gongshu Wang, Lixin Tang

We study an integrated charge batching and casting width selection problem arising in the continuous casting operation of the steelmaking process. For the general problem, we develop a column generation based branch and bound (B&B) solution approach to obtain optimal solutions. We also consider a frequently occurring case of the problem where each steel grade is incompatible with any other grade. For this special case, we develop a two-level polynomial-time algorithm to obtain optimal solutions.

2 - A Branch-and-Price-and-Cut Algorithm for Batch Annealing in Steel Industry

Ying Meng, Northeastern University, The Logistics Institute, Shenyang, 110004, China, ymeng@tli.neu.edu.cn, Lixin Tang, Zhi-Long Chen

We consider a batching decisions problem arising in the batch annealing operations and propose a branch-and-price-and-cut solution algorithm. To strengthen the upper bound, in addition to new columns, some valid inequalities are added to the formulation in every iteration of the column generation process. A variable reduction strategy is also proposed to accelerate the algorithm. For some special cases, polynomial-time solution methods are proposed to solve the problem optimally.

3 - Production Scheduling with Two-modal Transportation Consideration

Feng Li, Northeastern University, The Logistics Institute, Shenyang, 110004, China, fli@tli.neu.edu.cn, Zhi-Long Chen, Lixin Tang

Motivated by application in the steel industry, we study an integrated scheduling model of production and two-modal transportation. A set of jobs are first processed in a processing facility, then delivered to the port by trucks, and finally delivered to the customers by ships. We study various classes of problems. For each of the problems studied, we provide an efficient exact algorithm or a proof intractability accompanied by a heuristic algorithm with worst case analysis.

4 - An Improved Algorithm for a Single Machine Scheduling Problem with Delivery Coordination

Weiya Zhong, Professor, Shanghai University, Department of Mathematics, Shanghai, 200444, China, wyzhong@shu.edu.cn

We consider a scheduling problem with delivery coordination where a manufacturer needs to determine a joint schedule for order processing and order delivery. Order delivery is carried out by a third party logistics provider. The objective is to minimize total delivery cost such that all the orders are delivered before their due dates. We present an algorithm with worst case ratio of 5/3, which improves the known ratio of 2 of an existing algorithm in the literature.

■ TB15

15- West 202- CC

Software Demonstration

Invited Session

1 - Frontline Systems, Inc. - Analytic Solver Platform: No-Compromise Analytics in Microsoft Excel

Daniel Fylstra, President, Frontline Systems Inc., P.O. Box 4288, Incline Village NV 89450, United States of America, daniel@solver.com

Analytic Solver Platform, a deep integration of our Premium Solver, Risk Solver and XLMiner software, is a complete toolkit for predictive and prescriptive analytics – data mining, optimization and simulation. With a far lower learning curve than other analytics software, and unmatched performance on challenging large-scale models, it offers analysts "extreme productivity."

2 - Maximal Software - Deploying MPL Optimization Models on Tablet Computers and Mobile Platforms

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington VA 22201, United States of America, bjarni@maximalsoftware.com

The IT industry is currently undergoing a major shift to new platforms such as tablet computers and mobile phones. We will demonstrate a new server-based version of MPL OptiMax that makes writing mobile applications a relatively quick and easy process. We will take you through all the steps of implementing optimization projects - finally deploying the project on a server for servicing both web and mobile clients, using standard programming languages, such as C/C++ or Python.

■ TB16

16- West 207- CC

Modeling and Analysis of Perishable Inventory Systems with Random Input

Cluster: Tutorials

Invited Session

Chair: David Perry, University of Haifa, Department of Statistics, Haifa, 26250, Israel, dperry@stat.haifa.ac.il

1 - Perishable Inventory Systems with Random Replenishments

David Perry, University of Haifa, Department of Statistics, Haifa, 26250, Israel, dperry@stat.haifa.ac.il, Wolfgang Stadje

A guide to perishable inventory systems (PIS's) that are refilled by randomly arriving items and not by ordering decisions is introduced. The literature on this class of PIS's (for which a blood bank or an organ transplantation center are prominent examples) is sparse. The survey starts with the pioneering work on a prototype model in which item arrivals and demand arrivals form independent Poisson processes. We show how to compute all performance measures of interest for this PIS. Thereafter, extensions in several directions are reviewed, among them (i) PIS's with finite capacity and waiting demands; (ii) PIS's with renewal item arrival times; (iii) batch arrivals of items or demands; (iv) actuarial valuation; (v) optimization and control. Some novel contributions are also introduced.

■ TB17

17- West 208 B- CC

Joint Session INFORM-ED/CPMS:Teaching OR/MS Related Internships and Independent Studies

Sponsor: INFORM-ED & CPMS, The Practice Section

Sponsored Session

Chair: Eric Huggins, Associate Professor of Management, Fort Lewis College, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

1 - Applying Big OR/MS Concepts at a Small College in a Small Town

Eric Huggins, Associate Professor of Management, Fort Lewis College, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

Managing OR/MS related student internships in a small town creates unique challenges and opportunities. We discuss these challenges as well as successful strategies to develop and implement internships locally. We focus on one very successful internship, but draw insights from several others that had varying degrees of success.

2 - Three Keys to Successful Research Projects: Training, Teamwork, Timing

Mike Veatch, Gordon College, Department of Mathematics, 255 Grapevine Rd, Wenham, MA, 01984, United States of America, Mike.Veatch@gordon.edu

Our experience is that undergraduates can make significant contributions to O.R. research projects, spanning from software and numerical tests to model formulation, bounds, and derivations. Success hinges on picking highly motivated students, a carefully focused training program, building a project team, and creating sufficient time for student and advisor.

3 - A Taste of the Real World: Senior Capstone Projects

Susan Martonosi, Harvey Mudd College, Department of Mathematics, Claremont, CA, United States of America, martonosi@hmc.edu

A senior capstone is a project conducted during a student's final year, whose intention is to synthesize material learned in the classroom. For 50 years, the Harvey Mudd College Clinic Program has been a capstone experience in which teams of undergraduates work on a real-world problem of interest to a sponsoring organization. Over 1400 projects have been completed, many of them related to operations research. This talk will provide an overview of the program and suggest best practices.

■ TB18

18- West 208 A- CC

Scheduling and Logistics

Sponsor: Optimization/Computational Optimization and Software

Sponsored Session

Chair: R. Logen Logendran, Professor, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, Logen.Logendran@oregonstate.edu

1 - Decomposition Based Lower Bounds for a Dynamic PCB Assembly System

Mohammad Yazdani Sabouni, PhD Student, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, yazdanim@onid.orst.edu, R. Logen Logendran

We introduce the problem of integrating internal (machine) and external (kitting) setup times and a dynamic assembly system in the assembly of printed circuit boards (PCBs). Two algorithms are developed for this problem. Since obtaining the optimal solutions is practically difficult or even impossible, to evaluate the effectiveness of these algorithms, we use the Branch-and-Price methodology to decompose the original problem and iteratively construct a lower bound.

2 - Sequence-Dependent Group Scheduling in Hybrid Flowshops

Mir Abbas Bozorgirad, PhD Student, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, bozorgim@onid.orst.edu, R. Logen Logendran

We develop tabu search based algorithms to address a bi-criteria group scheduling problem in hybrid flowshops with the objective of minimizing the weighted sum of total weighted completion time and total weighted tardiness. There is a sequence-dependent setup time between different groups, and the job release times and machine availability times are considered to be dynamic. The performances of algorithms are evaluated and compared to each other to find the best algorithm for this problem.

3 - Inventory Deployment Decisions for Blockbuster's Online Movie Rental Business

Kyung Sung Jung, PhD Candidate, University of Texas at Dallas, Jindal School of Management, 800 W Campbell Rd., SM30, Richardson, TX, 75083, United States of America, kxj083000@utdallas.edu, Casey Chung, Shun-Chen Niu, Chelliah Sriskandarajah

Blockbuster has a subscriber-based online movie rental industry. Subscribers maintain rental queues and their demands are fulfilled corresponding to the higher queue positions. We model the demand of DVDs by using Blockbuster datasets, determine the initial order quantity, and propose the method to allocate DVDs to its distribution centers.

4 - Non-Permutation Schedules in Hybrid Flowshops: Tabu Search Algorithm Versus Genetic Algorithm

Mir Abbas Bozorgirad, PhD Student, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, bozorgim@onid.orst.edu, R. Logen Logendran

In a non-permutation schedule, positions of jobs are correlated, i.e. the position of a job in a stage can affect its positions in other stages. Tabu search (TS) is very effective in dealing with scheduling problems, but it only allows single perturbations in generating new solutions, so it may not capture those interdependencies. Therefore, TS is compared to genetic algorithm, which performs multiple perturbations, to find the best algorithm in hybrid flowshops with a bi-criteria objective.

■ TB19

19- West 211 A- CC

Disease Prevention and Immunization

Contributed Session

Chair: Brandon Pope, Purdue University, 315 N. Grant Street, West Lafayette, IN, United States of America, popeb@purdue.edu

1 - What Is the Right Balance between Prevention and Treatment of Disease?

George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org

There is little quantitative substantiation of the common assertion that disease prevention receives inadequate funding compared to treatment. We address this seeming paradox with a review of the arguments and the underlying evidence. We assess the amount spent on prevention, summarize the relative cost-effectiveness of prevention and treatment, analyze the interacting impacts of prevention and treatment spending levels on morbidity and mortality, and summarize research needs.

2 - Linking Disease and Supply Chain Models for Immunization Programs

Sheng-I Chen, University of Pittsburgh, 1033 Benedum Hall, Pittsburgh, PA, 152261, United States of America, shc61@pitt.edu, Bryan A. Norman, Jayant Rajgopal

Many disease transmission models have been applied to help make decisions about infectious disease control. Knowing disease transmission dynamics can impact vaccine distribution strategies. We propose a mechanism for linking disease transmission and vaccine distribution models and consider how supply chain constraints affect the health benefits of immunizations programs.

3 - Management of Chronic Illnesses through Prevention on US Healthcare Delivery System

Sameer Kumar, Qwest Endowed Chair and Professor of Operations and Supply Chain Management, University of St. Thomas, 1000 LaSalle Avenue, Minneapolis, MN, 55403, United States of America, skumar@stthomas.edu

A detailed closed loop business framework for system modeling on chronic disease prevention is proposed to study the interactions among two chronic diseases, related health risk factors, using regression analysis, preventive programs and associaed costs.Optimization provides minimum threshold values of prevention programs costs and reduction effect on health risk factors to achieve breakeven values for costs of prevention equal to savings from reduced direct treatment costs over time.

4 - Information-Based Incentives: Preventive Behaviors for Coronary Heart Disease

Brandon Pope, Purdue University, 315 N. Grant Street, West Lafayette, IN, United States of America, popeb@purdue.edu, Abhijit Deshmukh, Andrew Johnson, James Rohack

Incentives are increasingly promoted to support distributed decision-making in healthcare systems, including preventive behaviors. While the incentives literature focuses on financial reform, incentives are generally any mechanism that affects decision-making. We use a learning process of consumer behavior to model a policy maker's information provision problem as a MDP, and solve for optimal information provision policies regarding preventive behaviors pertinent to coronary heart disease.

5 - A MDP Model for Developing Breast and Ovarian Cancer Intervention Strategies for BRCA1/2 Carriers

Mehrnaz Abdollahian, PhD Student, Department of Industrial and Management Systems Engineering, University of South Florida, 2038 Gregory Drive, Tampa, FL, 33613, United States of America, mehrnaz@mail.usf.edu, Tapas Das

More than 300,000 women in the United States have the BRCA1/2 genes. They inherit 5 to 20-fold increased risks of developing breast and ovarian cancers. Cost-effective intervention strategies while decreasing the risks may save up to $800 million spent each year on treatment. We develop a Markov Decision Process model and use it to find an optimal intervention strategy based on data available in the literature on the various stages of the breast and ovarian cancer and the costs of interventions.

■ TB20

20- West 211 B- CC

Data for Health Care

Contributed Session

Chair: Keith Willoughby, University of Saskatchewan, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca

1 - Essential Data Resources, Strategies and Research Efforts to Inform Healthcare Reform Initiatives

Steven Cohen, Director, CFACT, AHRQ, 540 Gaither Road, Rockville, MD, 20850, United States of America, scohen@ahrq.gov

Policymakers depend on model-based estimates of the future state under alternative demographic, economic and technological assumptions to complement current state assessments. They estimate the impact of changes in financing, coverage and reimbursement policy, determining who benefits and who bears the cost. This presentation focuses on data capacity, statistical quality,research and modeling efforts to inform health reform initiatives with attention to the Medical Expenditure Panel Survey.

2 - A System Model for Implementing and Sustaining Evidence-based Healthcare Practice

Caitlin Hawkins, University of Southern California, 3715 S McClintock Ave., GER 240, Los Angeles, CA, United States of America, hawkinsc@usc.edu, Shinyi Wu

There is a need to develop a model to guide sustainable implementation of evidence-based healthcare practice at the local level. Through analyzing successful implementation and existing frameworks, a four-component model is proposed comprising data, behavior, support system, and culture. The model defines the context of an implementation by combining approaches from human factors engineering, organizational theory, and systems engineering. The model is tested against a national implementation.

3 - A Multi-agent System Model to Study US Health System

Pai Liu, University of Southern California, 2355, Scarff St., Apt 1, Los Angeles, CA, 90007, United States of America, liup04@gmail.com, Shinyi Wu

We proposed a multi-agent system model to study the US health delivery system and policy making. Our model includes interacting agents representing the key players in the health system. The agents would respond to the policy by changing their behaviors. This model can serve as a tool for decision makers to test different policy designs and scenarios to understand the complexity and mitigate the risks involved.

4 - Economic Analysis of the Hospitalist Program in the Saskatoon Health Region

Keith Willoughby, University of Saskatchewan, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca, Tim Kent, George Tannous

Recently, the Saskatoon Health Region launched a hospitalist program. Under this program, physicians work out of the hospital and primarily care for inpatients. We examined the hospitalist program's impacts on inpatient length of stay, readmissions, and rate of mortality. Although our results do not provide overwhelming evidence in support of the hospitalist program, we did identify a reduction in length of stay due to a change in physician payment structure.

■ TB21

21- West 212 A- CC

Security Games and Optimization on Networks

Sponsor: Optimization/Networks

Sponsored Session

Chair: Yevgeniy Vorobeychik, Sandia National Labs, 7011 East Ave, Livermore, CA, 94550, United States of America, eug.vorobey@gmail.com

1 - Adversarial Patrolling on Networks

Yevgeniy Vorobeychik, Sandia National Labs, 7011 East Ave., Livermore, CA, 94550, United States of America, eug.vorobey@gmail.com

We will address the problem of patrolling physical infrastructure on a network when an adversary aims to inflict damage on a target. We show that, in general, there exists a Stackelberg equilibrium in Markovian stationary strategies, and present general-purpose solution techniques. Additionally, we offer highly scalable methods for special cases.

2 - Cutting Plane Algorithms for Robust Multicommodity Network Design

Richard Chen, Senior Member of Technical Staff, Sandia National Laboratories, P.O. Box 969 MS 9155, Livermore, CA, 94551, United States of America, rlchen@sandia.gov, Robert Carr, Ojas Parekh, Cynthia Phillips

We present algorithms for solving the robust multicommodity network design problem. Given point-to-point demands, specified robustness requirements characterized by a budget-constrained disruption set and a capacity for each edge, find the minimum cost capacity expansion satisfying the given demands. In this talk I will describe the underlying problem, the model and the main components of our algorithms. Computational results from the Survivable Network Design Library are reported.

3 - Double Oracle Algorithms for Game-Theoretic Resource Allocation

Milind Tambe, University of Southern California, Los Angeles, CA, United States of America, tambe@usc.edu, Manish Jain, Jason Tsai

Many strategic actions carry a component beyond the immediate locale of the effort itself. To address the exponentially large strategy spaces that result, the RUGGED algorithm for road network domains uses best-response oracles and scales to real road networks of southern Mumbai. However, when contagion is present, computing best-responses is intractable. Thus, we extend RUGGED using heuristic oracles that enable it to scale to realistically sized leadership networks from counterinsurgency.

4 - Computing Optimal Strategies to Commit to in Stochastic Games

Joshua Letchford, Duke University, 308 Research Drive, Campus Box 90129, Durham, 27708-0129, United States of America, jcl@cs.duke.edu, Liam MacDermed, Vincent Conitzer, Ronald Parr, Charles Isbell

Significant progress has been made recently in the following two lines of research in the intersection of AI and game theory: (1) the computation of optimal strategies to commit to (Stackelberg strategies), and (2) the computation of correlated equilibria of stochastic games. We unite these two lines of research by studying both theoretically and experimentally the computation of Stackelberg strategies in stochastic games.

■ TB22

22- West 212 B- CC

Branching in Mixed-Integer Programming I

Sponsor: Computing Society

Sponsored Session

Chair: John Chinneck, Carleton University, Systems and Computer Engineering, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - The Watermelon Algorithm for the Bilevel Integer Linear Program

Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50011, United States of America, lzwang@iastate.edu, Pan Xu

Discrete bilevel optimization problems have been studied for more than two decades, but there are only a handful of algorithms, most of which are heuristic in nature. We present a so-called watermelon Algorithm for the bilevel integer linear programming problem, which can be proved to terminate finitely to the global optimal solution, if one exists. Computational experiment results will be reported to demonstrate the effectiveness of the algorithm.

2 - Branching on General Disjunctions

Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Serdar Yildiz

The use of general disjunctions for branching has been experimentally shown to decrease the size of the search tree. However, selecting good disjunctions is expensive and can easily lead to slower running times overall. In this talk, we focus on recent experimental work on choosing branching disjunctions heuristically. The methodology exploits the close connection between disjunctions used for branching and those used for cutting.

3 - Branching Objects in the CPLEX MIP Optimizer

Ed Klotz, Mathematical Programming Specialist, IBM, 926 Incline Way, Suite 100, Incline Village, NV, 89451, United States of America, klotz@us.ibm.com

While usually described in terms of integer variables, the branch and bound algorithm can branch on other elements of a MIP as well. This presentation will consider the strengths and weaknesses of additional branching objects supported by IBM's CPLEX optimizer, including special ordered sets, indicator constraints and general disjunctions. It will then examine some models where general disjunctions dramatically improve performance compared to branching on integer variables.

4 - Fast MILP Feasibility using General Disjunctions

John Chinneck, Carleton University, Systems and Computer Engineering, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca, Hanan Mahmoud

Branch and bound algorithms for MILP branch on a single variable at each node. General linear expressions of multiple variables are not often used because it is difficult to quickly find an effective general disjunction, and the overall algorithm may slow considerably. We show how to (i) trigger a general disjunction only when it is beneficial, and (ii) construct effective general disjunctions very quickly. We show performance improvements against a state of the art commercial MILP solver.

■ TB23

23- West 212 C- CC

Innovation in Analytics Award: Semi-finalist Presentations II

Sponsor: Analytics

Sponsored Session

Chair: Michael Gorman, University of Dayton, Dayton, OH, United States of America, michael.gorman@udayton.edu

1 - Using Shapley Value Analytics to Set Customer Satisfaction Priorities Based on Kano Theory

Kenneth M. Powaga, Sr. Vice President, GfK Custom Research, LLC, 8401 Golden Valley Road, Minneapolis, MN, 55427, United States of America, ken.powaga@gfk.com, Stan Lipovetsky, W. Michael Conklin

A key challenge with Customer Satisfaction Measurement is modeling the relationship between outcome and performance measures to deliver results that are actionable. This presentation demonstrates a unique method of Key Driver Analysis, KDA, based on Shapley Value Analysis from Cooperative Game Theory. It fits the non-linear and non-additive Kano Customer Satisfaction model by separating key drivers of dissatisfaction from the drivers of customer delight. KDA is an original non-regression technique which has been implemented with a web-tool and used globally for many clients in a variety of industries with actionable results that are validated with increased customer loyalty.

2 - Fully Adaptive Designs for Clinical Trials: Simultaneous Learning from Multiple Patients

Vishal Ahuja, PhD Candidate, University of Chicago, Booth Business School, Chicago, IL, 60637, United States of America, vahuja@chicagobooth.edu, John Birge

Traditional clinical trials are randomized and the goal is to maximize learning about treatment. Adaptive designs, on the other hand, allow clinicians to learn about treatment effectiveness during the course of the trial. In an adaptive design, allocation of patients to treatments evolves dynamically as the trial progresses. An ideal adaptive design maximizes patient health outcomes without sacrificing any potential learning. We propose such a design, one that fully exploits learning from multiple patients simultaneously. We demonstrate our design's effectiveness on a recent trial. Our design is general and applicable to any Markov decision process setting where learning takes place.

3 - Whole-hospital Operational Forecasting System

David S. Toledano, GE Global Research Center, Niskayuna, NY, 12309, United States of America, toledano@ge.com, Onur I. Dulgeroglu, Bex G. Thomas, Kunter S. Akbay, Peter L. Katlic

Hospitals make complex patient flow decisions throughout the day to manage admissions from Emergency, Surgery and elsewhere into a scarce supply of inpatient beds, with relatively little decision support to identify those likely to be over-subscribed. In partnership with the Mount Sinai Medical Center (MSMC) in New York, we are prototyping a novel whole-hospital forecasting system which accurately estimates patient flow movements and bed shortages over the next 24 hours and displays operational feedback through interactive dashboards. Our system utilizes real-time data and historical patterns within a discrete-event simulation and currently achieves in excess of 98% accuracy on forecast census at the hospital level.

■ TB24

24- West 213 A- CC

Analyzing Policy Options

Sponsor: Health Applications Society

Sponsored Session

Chair: Saied Samiedaluie, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, saied.samiedaluie@mail.mcgill.ca

1 - The Impact of Private Providers and Cross-border Policy on Public Healthcare Services

Dimitrios Andritsos, HEC Paris, 1 Rue de la Liberation, Paris, France, andritsos@hec.fr, Christopher Tang

We examine the impact of competition from private hospitals and a recent cross-border healthcare policy on public healthcare systems in the EU. We find that in border regions, where the cost of crossing the border is low, "outsourcing" the high-cost country's elective care services to the low-cost country is a viable strategy from which both countries' systems can benefit.

2 - The Treatment Trap: Modeling Physicians' Prescribing Behavior

Tinglong Dai, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15217, United States of America, dai@cmu.edu, Sridhar Tayur, Mustafa Akan

The Congressional Budget Office estimated that $700 billion per year is spent on unnecessary procedures. In the field of cardiology, above 25% of stent procedures, which are costly and can cause complications and infections, are unnecessarily prescribed. We develop a theoretical framework of physicians' prescribing behavior under congestion. For both inpatient and outpatient settings, we show a few operational and policy insights that depart from conventional wisdom.

3 - Optimal Inpatient Discharge Timing: A Simulation Study

Nan Kong, Assistant Professor, Purdue University, 206 S. Martin Jischke Drive, West Lafayette, IN, United States of America, nkong@purdue.edu, Pratik Parikh, Charuhas Thakar, Elizabeth Crawford

We focus on inpatient discharge timing, an important decision in acute hospital management. Academic literature and hospital practice indicate that medically-unnecessary delays in discharging patients could lead to a reduction in effective resource capacity and ED crowding, while aggressive discharge may result in higher readmissions and increased system load. In a simulation study, we analyze discharge policies considering resource utilization and patient wait times as key performance measures.

4 - Admission Policies in a Neurological Hospital Ward

Saied Samiedaluie, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, saied.samiedaluie@mail.mcgill.ca, Beste Kucukyazici, Dan Zhang, Vedat Verter

In this paper, we study patient admission policies in a neurological hospital ward, where there are multiple patient types with different medical characteristics. The patients need to wait in ED or ICU until a hospital bed is assigned to them. Each type of patient has different arrival rate, average length of stay and waiting cost. The problem is formulated as an average cost dynamic program over infinite horizon. An approximation scheme to solve the dynamic programming will be presented.

■ TB25

25- West 213 B- CC

Healthcare Analytics

Sponsor: Health Applications Society

Sponsored Session

Chair: Bruce Golden, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, bgolden@rhsmith.umd.edu

Co-Chair: Edward Wasil, Kogod School of Business, American University, Washington, DC, United States of America, ewasil@american.edu

1 - Does Multitasking Improve Productivity? Evidence from the Emergency Department

Diwas KC, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, Diwas_Kc@bus.emory.edu

We examine the effect of multitasking on performance in an emergency department. By drawing on recent findings in the experimental psychology literature we develop several hypotheses for the effect on performance. We find that multitasking has implications for the service encounter, including patient flow and quality of care.

2 - Data-driven Appointment Scheduling in the Presence of No-shows

Michele Samorani, Alberta School of Business, University of Alberta, Edmonton, AB, Canada, samorani@ualberta.ca, Linda LaGanga

We solve the problem of scheduling outpatient appointments in the presence of no-shows. Predictive analytics is used to forecast the show outcome of appointment requests, which, based on this prediction, are optimally scheduled. Descriptive analytics is used to interpret the output of this optimization problem in order to derive a heuristic policy. The prediction quality determines whether a clinic should adopt a single-day scheduling horizon or not, and whether it should overbook or not.

3 - Data Mining to Aid Beam Angle Selection for Intensity-modulated Radiation Therapy

Stuart Price, Robert H. Smith School of Business, University of Maryland, College Park, MD, United States of America, sprice@rhsmith.umd.edu, Hao Howard Zhang, Bruce Golden

A good IMRT plan is a set of beam angles and intensities that deliver radiation to the tumor while minimizing damage to healthy tissue. Fully evaluating intensities and performance from angle sets is computationally intensive, we data mine evaluated plans to create a model to screen angle sets before evaluation.

4 - Early Detection of Bioterrorism: A Combined Social and Spatial Network Analysis

Inbal Yahav, Assistant Professor, Bar Ilan University, Graduate School of Business, Ramat Gan, 52900, Israel, inbal.yahav@biu.ac.il, Sean Barnes, Bruce Golden, Edward Wasil

Bioterrorism is a significant threat to the US. The spread of certain agents may be difficult to distinguish from a seasonal flu outbreak. We simulate epidemic and bioterrorism outbreaks and propose a method for differentiating between the two scenarios when only a small proportion of the population becomes infected.

■ TB26

26- North 221 A- CC

Operational Models of Mergers and Alliances

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Soo-Haeng Cho, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, soohaeng@andrew.cmu.edu

1 - Strategic Supplier Alliances under Default Risk

Xiao Huang, Assistant Professor, Concordia University, 1455 de Maisonneuve Blvd. W, Montreal, QC, H3G1M8, Canada, xiaoh@jmsb.concordia.ca, Tamer Boyaci, Mehmet Gumus, Saibal Ray, Dan Zhang

We study alliance formation among a set of complementary/substitutable suppliers selling to an assembler/buyer. The suppliers balance the strategic benefit of joining large alliances (lower chance to default) vs operational benefit to stay with small alliances (higher profit allocation). Coalition-proof stable alliance structures are characterized. We also find that the assembler and the buyer's investment strategy in upstream risk construction have contrasting impact on the supplier community.

2 - United We Stand? Coordinating Capacity Investments in Joint Ventures

Guillaume Roels, Assistant Professor, UCLA, 110 Westwood Plaza, Los Angeles, 90095, United States of America, guillaume.roels@anderson.ucla.edu, Philippe Chevalier, Ying Wei

In this talk we study how to structure a joint venture between manufacturing firms that pool their resources in order to reduce their overall demand risk. In particular, we study whether capacity should be owned jointly or separately so as to ensure the joint-venture's long-term viability, depending on the number of partners, the magnitude of economies of scale, and the degree of asymmetry between partners.

3 - Vertical Integration under Competition: Forward, Backward, or No Integration?

Ali Parlakturk, Assistant Professor, University of North Carolina-Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, ali_parlakturk@unc.edu, Yen-Ting Lin, Jayashankar M. Swaminathan

We consider two competing supply chains, each consisting of a supplier, a manufacturer and a retailer. The supplier controls the product quality, and the retailer sets the retail price. Each manufacturer can choose to (1) forward integrate, (2) backward integrate, or (3) staying disintegrated. We analyze the resulting equilibrium supply chain structure, and examine the effects of competition, demand perishability, and cost of improving quality on manufacturers' choice.

4 - Newsvendor Mergers

Xin Wang, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, xinwang1@andrew.cmu.edu, Soo-Haeng Cho

We study how a merger of two price-setting competitive newsvendors will affect the prices, inventories, and expected profits of merging newsvendors and their competitors in an oligopolistic market. By evaluating the pooling effect of a merger and stock-out competition under uncertain demand, we demonstrate that demand uncertainty, which has been ignored in the economics literature, can have a significant influence on both direction and magnitude of the impact of a merger.

■ TB27

27- North 221 B- CC

Modeling and Learning Demand

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Adam Mersereau, University of North Carolina-Chapel Hill, CB 3490, Chapel Hill, NC, 27599, United States of America, ajm@unc.edu

1 - Dynamic Pricing Model for a Duopoly Market

Xin Liu, Postdoc, University of Minnesota, Institute for Mathematics and it's Applications, Minneapolis, MN, 55455, United States of America, liuxin@ima.umn.edu, William Cooper

We study a duopoly with two sellers. Each of the sellers has one product. We focus on a linear demand model, namely, the demand of each product depends on prices of both products linearly. We obtain a sufficient condition, under which the prices converges to the Nash equilibrium prices. Such a sufficient condition can be formulated in terms of the covariance matrix of the prices. In particular, the correlation between two prices play an important role for the asymptotic optimality.

2 - On Information Distortion in Online Ratings

Omar Besbes, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu, Marco Scarsini

We analyze the interplay between past and future ratings due to the sequential nature of reports. We show that, for a broad class of behavioral models, and mixture thereof, the long-run average of sequentially declared ratings, when well defined, preserves stochastic order of the true rating. In addition, we show that there exist behaviors that allow manipulations of the long-run average of sequentially declared ratings through a finite number of fake reviews.

3 - Promotion Optimization for Grocery Retailers

Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@MIT.EDU, Maxime Cohen, Zachary Leung, Kiran Panchamgam, Andrew Vakhutinsky

Promotion planning is an important process for retail grocery chains. We formulate the problem of optimizing promotions for products in a category, i.e. deciding which products to promote, using which promotion vehicles, and at what prices. Our demand model captures several key effects that arise in practice (complementary and substitution effects, promotion fatigue). This gives rise to a hard problem. We propose and compare various solution methods for the problem.

4 - Demand Estimation from Censored Observations with Inventory Record Inaccuracy

Adam Mersereau, University of North Carolina-Chapel Hill, CB 3490, Chapel Hill, NC, 27599, United States of America, ajm@unc.edu

We consider a newsvendor estimating a demand distribution from historical sales data. The newsvendor uses stocking levels to account for censoring but these stocking levels are subject to unobserved errors. We discover a systematic downward bias in demand estimates even while service levels may appear to the firm to exceed targets. We propose a heuristic correction that sharply reduces the bias.

■ TB28

28- North 221 C- CC

Sourcing Strategies for Retailers and Manufacturers

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Damian Beil, Associate Professor, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48103, United States of America, dbeil@umich.edu

1 - Bargaining for an Assortment

Sebastian Heese, Associate Professor, Indiana University Bloomington, 1309 E. 10th Street, Bloomington, IN, 47405, United States of America, hheese@indiana.edu, Goker Aydin

Consider a retailer who must compose an assortment from products offered by different manufacturers. We propose a model in which the retailer engages in simultaneous bilateral negotiations with individual manufacturers. We characterize the equilibrium assortment and profit allocation, and we explore how the equilibrium depends on manufacturer and product characteristics.

2 - Framework Agreements in Procurement: An Auction Model and Design Recommendations

Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu, Yonatan Gur

Framework agreements (FAs) are procurement mechanisms that are commonly used to satisfy demand that arises randomly over time. We develop the first model of suppliers' risks in FAs, focusing on cost uncertainty. We study different mechanisms that mitigate these risks and reduce buying prices. Our results provide important prescriptions that are being used by the Chilean government to improve the design of their FAs worth a billion dollars per year.

3 - Deploying Test Auctions to Assist with Supplier Qualification Decision-Making

Brendan See, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48104, United States of America, bdsee@umich.edu, Damian Beil, Izak Duenyas

Entrant suppliers must undergo a costly qualification process prior to competing in a procurement auction. We evaluate when a buyer can benefit from holding multiple auctions when the supply base consists of both qualified incumbents and not-yet-qualified entrant suppliers who can be qualified at a cost. The buyer faces a trade-off between increased supplier competition and revealing supplier cost information. We extend the model to incorporate a credible reserve price and TIOLI offer.

4 - Demand Estimation and Ordering under Censoring: Stock-out Timing is (almost) All You Need

Tong Wang, Assistant Professor, National University of Singapore, 15 Kent Ridge Drive, Singapore, 119245, Singapore, tong.wang@nus.edu.sg, Aditya Jain, Nils Rudi

Retailers learn about demand by observing sales. However, this learning is limited by the amount of inventory a retailer carries. This loss of information due to censoring requires a retailer to carry excess inventory. We propose a new way of learning about demand with significantly simple sufficient statistics. We analyze this demand learning method for a simple multi-period Newsvendor setting. We provide a comparison between stock-out timing and stock-out event based demand updating.

■ TB29

29- North 222 A- CC

Empirical Investigations into Delivery of Healthcare

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, Sarang_Deo@isb.edu

1 - Stress on the Ward: Evidence of Safety Tipping in Hospitals

Stefan Scholtes, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, s.scholtes@jbs.cam.ac.uk, Ludwig Kuntz, Roman Mennicken

We confirm the existence of workload-related safety tipping points for in-hospital mortality using discharge records of 83,485 patients in 234 clinical departments. We use a survival model with discharge selection and estimate that 12% of all deaths of patients who experience workload above the tipping point can be explained by workload.

2 - Docs under Load: The Endogenous Nature of Work Content in an Emergency Department

Robert Batt, The Wharton School, University of Pennsylvania, 3730 Walnut St., Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, batt@wharton.upenn.edu, Christian Terwiesch, Olan Soremekun

We present an empirical study of an emergency department that focuses on the endogenous nature of work content per patient. We show that triage nurses & physicians adjust the number of diagnostic tests ordered per patient in response to the level of crowding in the system. During times of crowding, more diagnostic testing is ordered at triage in an effort to improve throughput. However, this leads to an overall increase in testing when the system is most congested.

3 - Analytics for OR Access at a Large Teaching Hospital

Retsef Levi, Massachusetts Institute of Technology, 100 Main Street, Building E62-562, Cambridge, MA, United States of America, retsef@mit.edu, Vivek Farias, Ryan Graue

We leverage predicability in seemingly highly variable utilization patterns via tools that (a) predict utilization of a user defined set of surgical resources at some future time using relevant historical patterns and existing block booking data and (b) consolidate resource utilization in a manner that respects surgeon preferences/ constraints. These tools help Beth Israel Deaconess Medical Center identify and utilize surgical resources that would otherwise have been lost.

4 - Heterogeneity in Physician Performance: Efficiency vs. Flexibility

Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, Sarang_Deo@isb.edu, Aditya Jain

We use patient flow data at a not-for-profit, specialty eye care clinic to investigate the impact of case-mix heterogeneity at the physician level on time spent by patients in the clinic after controlling for other operational factors such as overall workload, complexity of patients, fresh vs. follow-ups, appointments vs. walk-ins, paying vs. non-paying etc. We use the results of our analysis to empirically characterize the trade-off between efficiency and flexibility of individual physicians.

■ TB30

30- North 222 B- CC

Commodity Procurement and Processing

Sponsor: Manufacturing & Service Oper Mgmt/iFORM

Sponsored Session

Chair: Ankur Goel, Case Western Reserve University, Cleveland, Cleveland, United States of America, axg312@case.edu

1 - Procurement Strategies for Multiple Inputs

Pascale Crama, Singapore Management University, 50 Stamford Road, Singapore, 78899, Singapore, pcrama@smu.edu.sg, Onur Boyabatli

This paper analyzes the procurement decision of a firm that produces a single commodity output using two commodity inputs. The firm can source the two inputs in advance of the selling season through long-term contracts or from the spot markets. We investigate the impact of using different contract types (fixed-price versus index-priced) on the profitability of the firm. The main motivation comes from a soda ash producer located in India that procures multiple commodity inputs for production.

2 - The Value of Operational Flexibility in Uncertain Supply and Demand Environments

Xiaole Wu, Assistant Professor, Fudan University, Room 513, Siyuan Building, 670 Guoshun Road, Shanghai, 200433, China, wuxiaole@fudan.edu.cn, Lingxiu Dong, Panos Kouvelis

Refining is indispensable to almost every natural resource and agricultural commodity based industry. We investigate the interconnection among input procurement, intermediate processing, and output blending decisions in the refining process. We offer insights on how the market conditions affect the value of conversion flexibility and its interaction with range flexibility.

3 - An Integrated Approach to Commodity Risk Management

Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl, Genaro Gutierrez

In this paper, we examine the integrated operating and financial hedging decisions of a value maximizing firm, under the presence of capital market imperfections. Motivated by the flour milling industry, we consider a commodity processor who buys a certain commodity, converts it into a final product and sells it to the end customers. In presence of costly external funds, we derive the optimal value-maximizing policy and compare it with a simple short-hedge.

4 - Operational Flexibility and Valuation of Oil Refinery Operations

Sripad Devalkar, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sripad_devalkar@isb.edu, Ankur Goel

We model a crude oil refinery that has operational flexibility in blending different grades of crude oil and adjusting the mix of output products produced upon refining. Using a multi-period stochastic dynamic programming formulation, we explore the interconnections between the input (crude) procurement and output product mix decisions and quantify the value of blending and refining flexibilities.

■ TB31

31- North 222 C- CC

Innovative Modern Service and Inventory Systems

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations
Sponsored Session

Chair: Robert Swinney, Associate Professor, Graduate School of Business, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, swinney@stanford.edu

1 - Would the Social Planner Let Bags Fly Free?
Gad Allon, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo

In June 2008, American Airlines became the first major US airline to institute a fee on the first checked bag. Within 18 months, nearly every other major carrier followed suit. Here, we examine whether the fees are socially efficient. We find that the fees are in fact Pareto improving. While customers may dislike the fees, they are a means to alter customer behavior and thus reduce the airline's costs. Customers are compensated by lower base fares.

2 - On the Correlation between Waiting Times and Service Speed
Pnina Feldman, Haas School of Business, UC Berkeley, 545 Student Services Bldg #1900, Berkeley, CA, 94720, United States of America, feldman@haas.berkeley.edu, Jing Dong, Galit Yom-Tov

The service operations literature typically assumes that firms control service times and that those are independent of the time customers spend waiting. Empirical evidence suggests otherwise. In fact, the time consumers spend in line affects their expectations on service length. Some consumers require longer service after waiting a long time and others expect a rushed service. We examine how such correlations affect the firm's operational performance.

3 - Learning Quality from Service Outcomes
Senthil Veeraraghavan, Associate Professor, The Wharton School, 3730 Walnut Street Suite 550, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We study a service provider whose service value is unknown to arriving customers. Service outcomes are random depending on the quality of the service provider. Customers decide whether to join the service, or renege from the service based on the limited service outcomes/reviews that they observe. We consider how service policies influence consumer learning and social welfare.

4 - The Groupon Effect: Threshold-Discounting with Strategic Customers
Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu, Simone Marinesi, Karan Girotra

We analyze the business model of Groupon which offers discounts to customers if a sufficient demand for service is reached. We show when Groupon business model works best and suggest improvements for its design.

■ TB32

32- North 223- CC

Impact of Environmental Policy on the Durable Products Supply Chain

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain
Sponsored Session

Chair: Haoying Sun, Assistant Professor, Texas A & M University, 4217 TAMU, College Station, TX, 77843, United States of America, hsun@mays.tamu.edu

1 - Design for Recovery or Obsolescence: The Impact of Take-Back Legislation
Ximin Huang, College of Management, Georgia Institute of Technology, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, ximin.huang@mgt.gatech.edu, Atalay Atasu, Beril Toktay

We consider a monopolist who has two product design options to manage the end-of-life costs/revenues associated with its products: making products more durable or recyclable. We explore how the recyclability and durability choices are affected by the requirements of take-back legislation.

2 - Effect of Government Subsidies on the Adoption of Resource Efficient Products
Haoying Sun, Assistant Professor, Texas A & M University, 4217 TAMU, College Station, TX, 77843, United States of America, hsun@mays.tamu.edu, Steve Gilbert

We use the durable goods framework to study how various forms of government subsidy programs shift consumer's adoption of resource efficient products and how this in turn affects consumption of scarce natural resources.

3 - Regulating Markets for Valuable Waste
Gokce Esenduran, Ohio State University, College of Business, 656 Fisher Hall Fisher, Columbus, OH, 43210, United States of America, esenduran_1@fisher.osu.edu, Luk Van Wassenhove, Atalay Atasu

Take-back legislation mandates minimum recovery rates for waste products. The recoverable value in waste products may create competition between producer and scavenger, and divert them from landfills even under no legislation. We identify the conditions where legislator should not distort an efficient waste market by imposing recovery targets.

4 - Competing with Bandit Supply Chains
Meng Li, Phd Student, The University of Texas at Dallas, Richardson, TX, 75080, United States of America, mxl086000@utdallas.edu, Suresh Sethi, Jun Zhang

We study competition between a mainstream firm and a decentralized bandit supply chain. Due to the free-riding effect, the bandit supply chain may even offer higher quality products than the mainstream firm. Finally, the mainstream firm's profit as a function of the free-riding effect is U-shaped, so that free-riding by the bandit supply chain may eventually benefit the mainstream firm.

■ TB33

33- North 224 A- CC

Inventory Management with Stochastic and Changing Demand

Contributed Session

Chair: Burcu Aydin, HP Labs, 1501 Page Mill Rd. 1U MS 1140, Palo Alto, CA, 94304, United States of America, aydin@hp.com

1 - Perturbed Demand and Penalty Cost Inventory Models: Optimal Policy Correspondence
James Lavin, NC State University, 400 Daniels Hall, Raleigh, NC, 27695, United States of America, jalavin@ncsu.edu, Donald Warsing, Anita Vila-Parrish, Russell E. King, Semra Ahiska

In contrast to penalty cost models, perturbed demand models explicitly consider a loss of future demand as a consequence of stock-outs. In a multi-period setting, we formulate and solve a problem in which realized demand in later periods is affected by fulfillment performance in earlier periods. The financial impact of the potential revenue loss on the optimal perturbed demand policy can be directly related back to traditional penalty cost models, giving insights into the correspondence.

2 - On-line Dynamic Inventory Control with Nonstationary Demands
Jianfeng Mao, Assistant Professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, Singapore, maoeco@live.com

We consider an on-line inventory control in single-echelon systems with nonstationary demands over multiple periods. Most of state-of-art inventory control methods require the assumption of i.i.d demands, which is not realistic in a disruptive supply chain. We develop a novel on-line inventory control algorithm to efficiently compute the optimal order in a real-time fashion by introducing a "best solution in probability" obtained by solving a series of off-line inventory control problems.

3 - Advance Demand Information in a Multi-Item System
Fernando Bernstein, Professor, Duke University, 100 Fuqua Drive, Durham, 27708, United States of America, fernando@duke.edu, Greg DeCroix

We consider a firm that can obtain one of two types of advance information about demand for the two products it sells: total demand volume across products and the mix of demand between products. For each type of information, we derive closed form expressions for optimal capacities in two different settings – one with a flexible resource and one without. We then compare the impacts of the two information types and the presence/absence of flexibility on capacity choices and firm profits.

4 - Bayesian Inventory Management with Potential Change-points in Demand
Zhe Wang, University of North Carolina-Chapel Hill, CB 3490, Chapel Hill, NC, 27599, United States of America, zhe_wang@unc.edu, Adam Mersereau

We consider an adaptive inventory control problem in which at some known potential change-points, the demand process may change abruptly with some probability. The underlying demand process is never revealed to the decision maker. Using a Bayesian framework, we analyze the behavior of the optimal policy as demands are observed and the decision maker's beliefs evolve over time.

5 - Collaborative Forecasting in Inventory Management
Burcu Aydin, HP Labs, 1501 Page Mill Rd., 1U MS 1140, Palo Alto, CA, 94304, United States of America, aydin@hp.com, J.S. Marron

We investigate implications of forecast sharing in a Collaborative Inventory Management setting. Some of the well-known forecast drivers, together with correlations generated by the interactive nature of shared data and the inherent white noise create a rich and complex data set. We analyze the interactions of forecast values with the responses in a supply chain setting with information sharing.

■ TB34

34- North 224 B- CC

Emotions and Innovation Management

Cluster: New Product Development

Invited Session

Chair: Manuel Sosa, Associate Professor of Technology and Operations Management, INSEAD, 1 Ayer Rajah Ave., Singapore, 138676, Singapore, manuel.sosa@insead.edu

1 - The Design Challenges of Experiential Services
Yannis Bellos, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, United States of America, Ioannis.Bellos@mgt.gatech.edu, Stylianos Kavadias

In this paper we explore the design challenges of an organization that develops an experiential service. Building on the customer journey concept, which maps an experiential service to customer-provider interaction touchpoints, we analyze the service provider's design decisions: the touchpoints she controls, and the price she charges. We fully characterize the conditions under which the provider can use her design decisions to successfully signal service quality.

2 - Idea Generation and the Role of Feedback
Joel Wooten, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States of America, jwooten@wharton.upenn.edu, Karl Ulrich

In many innovation settings, ideas are generated over time and managers face a decision about if and how to provide in-process feedback about the quality of submissions. We use innovation tournament field experiments to examine the effect of feedback on idea generation and show individual-level differences between no feedback, random feedback, and directed feedback.

3 - A Structured Approach to Identify Styles in Designs
Tian Chan, PhD Student, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, TianHeong.Chan@insead.edu, Jurgen Mihm, Manuel Sosa

A style is an organizing principle based on categorizing visually similar designs into a describable concept. This paper presents a structured approach to identifying styles using cluster analysis. Design patent data provides a unique opportunity to analyze style on a large scale due to a tightly controlled citation process which conveys similarity in visual impression between designs. Finally, we test styles developed using this approach against theory and perceptual experiments.

■ TB35

35- North 225 A- CC

New Applications in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Itir Karaesmen, American University, 4400 Mass Avenue NW, Washington, DC, United States of America, karaesme@american.edu

1 - Donor Behavior and Nonprofit Marketing Resource Allocation
Itir Karaesmen, American University, 4400 Mass. Avenue NW, Washington, DC, United States of America, karaesme@american.edu

We study repeat donor behavior and build statistical models to predict donor behavior based on internal and external factors associated with a nonprofit organizations marketing campaigns. These models can be used to reallocate marketing resources to increase effectiveness of the marketing campaigns.

2 - Robust Revenue Management with Hybrid Information
Yingjie Lan, Peking University, Guanghua School of Management, Beijing, 100871, China, ylan@gsm.pku.edu.cn, Michael Ball, Itir Karaesmen

We study the joint decision of seat allocation and overbooking with hybrid information quality. Information with mixed quality arises as no-show records are accurate and more stable, while demand data is often censored and more volatile. We optimize the worst case performance and solve the problem as a zero-sum game. Our numerical results show the practical relevance of our method.

3 - Conditional Promotions and Consumer Overspending
Thunyarat (Bam) Amornpetchkul, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, thunyara@umich.edu, Hyun-Soo Ahn, Ozge Sahin

Conditional promotions (e.g. spend $50 get 30% off, spend $50 get $15 off) are widely used in retail pricing. They are especially effective when some consumers are deal-prone (obtain transaction utility from purchasing at a discount). We compare two most common discount policies: percent-off and dollar-off, and show that both policies can lead to consumer overspending. We also show, depending on the nature of the product, one discount policy can perform better than the other.

■ TB36

36- North 225 B- CC

Quality, Pricing, and Channel Decisions

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Xuying Zhao, University of Notre Dame, Notre Dame, IN, United States of America, Xuying.Zhao.29@nd.edu

1 - Distribution Channel Structure for Competing Supply Chains with Price and Lead-Time Sensitive Demand
Lucy Gongtao Chen, NUS Business School, National University of Singapore, 119245, Singapore, bizcg@nus.edu.sg, Jihong Ou, Zhengping Wu

We consider two competing manufacturers that sell substitutable products to customers who are sensitive to both price and delivery lead-time. Each manufacturer can sell either through a company-owned store or through an independent retailer. We identify the equilibrium channel strategies and analyze the driving forces behind the equilibrium. We also discuss how structural assumptions affect the equilibrium.

2 - Pricing Strategies in Advance Selling
Xuying Zhao, University of Notre Dame, Notre Dame, IN, United States of America, Xuying.Zhao.29@nd.edu, Zhan Pang

We study and compare three pricing strategies in advance selling: dynamic pricing, price commitment, and pre-order price guarantee. We find that a seller benefits from demand uncertainty when pre-order price guarantee is used in advance selling.

3 - Making Quality Decisions in Tough Economic Times
Leon Chu, University of Southern California, Los Angeles, CA, United States of America, leonyzhu@usc.edu, Lian Qi, Rachel Chen

This paper analyzes a two-dimensional model for firm's optimal quality decisions where consumers vary both in their reserve utility for the product and in their sensitivity towards the quality. While the firm may want to offer lower quality products when the consumers' quality sensitivities deteriorate, the optimal response towards changes in the reserve utility depends on the target consumer groups. Our study highlights the importance of separating reserve utility from the quality sensitivity.

4 - Optimal Project Size in the Presence of Moral Hazard in Teams and Limited Commitment
George Georgiadis, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, United States of America, georgiadis@ucla.edu, Steven Lippman, Christopher Tang

We study the interaction between a team of agents who work to complete a project and a manager who selects its requirements. The main result is that with limited commitment, the manager extends the project as it progresses, which induces the agents to work less, thus rendering all parties worse off. We show that the manager should delegate the choice of the requirements to the agents or foster a relatively uncooperative environment within the team unless she has sufficient commitment power.

■ TB37

37- North 226 A- CC

P-Median and Variants

Sponsor: Location Analysis

Sponsored Session

Chair: Erhan Kutanoglu, The University of Texas at Austin, 204 E Dean Keeton St. C2200, Austin, TX, 78712, United States of America, erhank@mail.utexas.edu

1 - Interactive Location Decisions: An Airport Example

Yupo Chan, University of Arkansas at Little Rock, 2801 South University, Little Rock, AR, 72204, United States of America, yxchan@ualr.edu

Using airport location as an example, an interactive multicriteria decision-process is discussed. Without specifying the utility/value function, the tradeoff between travel time and noise impact is accomplished using a Frank-Wolfe optimization procedure. Computational results for both network location and planar location problems are presented, which are shown to be consistent with existing theories in continuous and discrete location.

2 - An Empirical Evaluation of P-median Problem Reformulations

Roger Rios, Professor, Universidad Autonoma de Nuevo Leon, Graduate Program in Systems Engineering, AP 111-F, Cd. Universitaria, San Nicolas de los Garza, NL, 66450, Mexico, roger@yalma.fime.uanl.mx, Ana Laura Gonzalez

Recently, Church proposed a reformulation and solution procedure for the p-median problem. Later, Elloumi proposed a different reformulation for the problem suggesting this could be embedded within an exact optimization method. In this talk we present an algorithm for the p-median problem that relies in the Elloumi's problem reformulation. The algorithm is compared to the procedure proposed by Church on a set of benchmark instances.

3 - Economies of Scale in Hub Location Problems

James Campbell, University of Missouri-St Louis, College of Business Administration, St Louis, MO, 63121, United States of America, campbell@umsl.edu

Basic hub location formulations use a simple model for transportation cost with a flow-independent discounted cost rate on inter-hub links to model economies of scale from flow consolidation. However, in optimal solutions inter-hub flows are often exceeded by flows on some spokes; yet the smaller inter-hub flows receive the cost discount. This paper examines optimal passenger and freight flows to document this behavior and suggests improvements in modeling economies of scale for hub location.

■ TB38

38- North 226 B- CC

Panel Discussion: Teaching Service Science

Sponsor: Service Science

Sponsored Session

Chair: Sheneeta White, University of St. Thomas, 2115 Summit Ave, MCH 316, St. Paul, MN, 55016, United States of America, whit6237@stthomas.edu

1 - Panel on Teaching Service Science

Moderator: Sheneeta White, University of St. Thomas, 2115 Summit Ave., MCH 316, St. Paul, MN, 55016, United States of America, whit6237@stthomas.edu, Panelists: Sanjeev Bordoloi, Turgut Akin, Jeffery Smith, Christoph Heitz

This panel will discuss all aspects of teaching service science at the undergraduate and graduate levels. The panel will compare and contrast teaching service science versus service operations. We will cover a wide array of pedagogical concerns such as textbooks, cases, course topics, assessments, etc. There will also be a discussion of the appropriateness of having a service-focused course as part of a business school curriculum.

■ TB39

39- North 226 C- CC

Production and Assignment Problems

Contributed Session

Chair: Fadime Uney-Yuksektepe, Assist. Prof., Istanbul Kultur University, Atakoy Campus, Department of Industrial Engineering, Istanbul, 34156, Turkey, f.yuksektepe@iku.edu.tr

1 - Multistage Stochastic Modelling of Global Production Planning under Uncertainty

Lin Zhu, Mr., University of Southampton, University Road, Southampton, SO17 1BJ, United Kingdom, lz1d10@soton.ac.uk, Yue Wu, Honora Smith

This paper examines a multi-period, multi-product and multi-plant global production planning problem from a global apparel manufacturing company, whose headquarters is in Hong Kong, manufacturing plants are in several Asia countries and sale departments are in Northern America and Europe. We propose a multistage stochastic recourse model to handle the uncertain market demand and import quota. Computational results demonstrate the effectiveness of the multistage model.

2 - Emergency Operations Scheduling of a Supply Chain Network

Hui Dong, Rutgers Business School, 1301 Wall Street, Lyndhurst, NJ, 07071, United States of America, huidong@pegasus.rutgers.edu, Lei Lei, Kangbok Lee

We present a mathematical model for emergency operations scheduling of a multi-echelon supply network of medical supplies. Each demand point has an order quantity and an expected delivery time, and each facility on the network has a capacity. The objective is to minimize the total tardiness. An approximation algorithm is proposed and evaluated through simulation.

3 - A Heuristic Solution for Consultant Routing and Assignment Problem

Yuanyuan Dong, Student, Southern Methodist University, 6425 Boaz Lane, Dallas, TX, 75205, United States of America, ydong@smu.edu, Junfang Yu

This paper presents a heuristic solution for a consultant routing and assignment problem. The objective is to minimize the total consultant travel cost. Different consultants may have different skill sets and different consulting tasks may need different skills. The skill matches between the consultants and consulting tasks are considered.

4 - On Pricing and Composition of Multiple Bundles

Juan-Carlos Ferrer, Associate Professor, P. Universidad Catòlica de Chile, Casilla 306 Correo 22, Santiago, Chile, jferrer@ing.puc.cl, Gabriel Bitran, Alejandro Cataldo

We study the problem facing a firm of determining the optimal composition and pricing of multiple bundles offered in a market with competition. We assume that the prices and characteristics of the competitor's bundles are known and that the competition does not react in the short run to the firm's decisions. Consumers are assumed to be rational and to maximize a random utility function. We use a mixed integer non-linear program, and a novel two-phase solution approach is therefore developed.

■ TB40

40- North 227 A- CC

Joint Session ENRE/SPPSN: Carbon Abatement Policies

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability & Public Programs, Service and Needs

Sponsored Session

Chair: Xu (Cissy) Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 1 Amherst Street, E40-211, Cambridge, MA, 02142, United States of America, xu_yang@mit.edu

1 - A Carbon Emission Cost Based Economic Production Quantity Model

Zhi Tao, Kent State University, 475 Terrace Drive, Kent, OH, United States of America, ztao@kent.edu, Alfred Guiffrida, Felix Offodile

This paper integrates carbon emission cost into the economic production quantity model and investigates the tradeoff results of both economic concern and environmental concern. The findings provide optimal decisions on production quantity, carbon emission and minimum budget for carbon emission conscious manufacturers and also shed light on carbon emission management.

2 - Pollution and Production
Francois Giraud-Carrier, University of Utah, David Eccles School of Business, 1645 E Campus Center Dr, Salt Lake City, UT, 84112, United States of America, f.giraud-carrier@business.utah.edu, Krishnan Anand

We compare three popular pollution control mechanisms–Cap, Cap-and-Trade, and Tax– to each other and to the Groves mechanism. We compare outcomes along several economic variables, including output, firm profits and welfare. We show that firms always reduce output to meet any pollution constraint. We discuss an important implication of the output reduction effect on welfare: the tax rate that achieves Groves is higher, and the cap under Cap-and-Trade lower, than those that maximize welfare.

3 - Price Containment in Cap and Trade Policies
Yihsu Chen, Assistant Professor, University of California, Merced, 5200 N. Lake Rd, Merced, CA, 95343, United States of America, yihsu.chen@ucmerced.edu, Andrew Liu

Various instruments are available in existing or proposed policies to contain price volatility of permits. We examine the effect of a price ceiling & floor on the investment of new capacity. Besides undesirable emission consequences, we find that the price-ceiling could also lead to over-investment due to the inflated consumption induced by low power prices when the permit prices are capped. On the other hand, a permit floor would result in an under-investment in new capacity.

4 - Price vs Quantity Regulation for Price Setting Firms
Cristian Figueroa, Operations Research Center Massachusetts Institute of Technology, 77 Massachusetts Ave. Bldg. E40-149, Cambridge, MA, 02139, United States of America, cfiguero@mit.edu, Xin Chen, David Simchi-Levi

In a market producing an externality requiring regulation, we analyze two methods: Pigovian tax and quotas sold for the externality. We show equivalence in a deterministic setting with full information. When demand uncertainty is introduced, we characterize equilibria. Under linear demand and quadratic costs, we show that equilibria inducing the same average price and average emissions, have different outcomes in terms of profits for the producers as well as revenue for the regulator.

5 - Estimation Model of Carbon Emissions for Freight Transport under Conditions of Megacities
Josue Velazquez, PhD Student, Monterrey Tech, Carlos Lazo 100 Santa Fe, Mexico City, Mexico, josue.velazquez@itesm.mx, Edgar Blanco, Jan Fransoo

Most methodologies used to estimate carbon emissions due to freight transport activities are based on parameters of developed countries. We conduct a field study for a Parcel Company in Mexico City to provide a model to estimate carbon emissions under conditions of megacities. Using empirical data we compare the model against methodologies used in the US and Europe and the results confirm significant differences among the estimated emissions.

■ TB41

41- North 227 B- CC

Forestry Session III

Sponsor: Energy, Natural Res & the Environment/Forestry
Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Design and Analysis of Wood Pellet Supply Chain
Mahdi Mobini, University of British Columbia, Department of Wood Science, Faculty of Forestry, Vancouver, BC, V6T 1Z4, Canada, Mobini@ubc.ca, Taraneh Sowlati, Shahab Sokhansanj

We present a new simulation model for the wood pellet supply chain which considers the supply of raw materials, their transportation, production of pellets and finally distribution of pellets to domestic and international customers. It is based on a typical pellet mill in Canada and provides estimates of the cost and amount of delivered wood pellets. The model is used to evaluate different scenarios and the effects of changes in the supply chain on the outputs of the model.

2 - Estimating Future Impacts of Stochastic Wood Supply Risks
Peter Rauch, BOKU-University of Natural Resources and Life Sciences, Institute of Production and Logistics, Feistmantelstrasse 4, 1180 Wien, Vienna, Austria, peter.rauch@boku.ac.at

In Austria procurement of (combined) heating plants firing woody biomass is threatened by recent trends like climate change, restrictions on imports, booming wood demand in emerging nations, and rising bioenergy demand in neighboring countries. The System Dynamics model of the Austrian wood supply "RiskHo" was developed to examine the mid- and long-term impacts of supply risks on wood supply and includes key stochastic risk agents with Monte Carlo simulation.

3 - The Computational Properties of Model 4 Harvest Scheduling Models
Rachel St.John, University of Washington, Seattle, WA, United States of America, rkrieg@washington.edu, Sandor Toth

Model 4 is a new spatially explicit harvest scheduling model that uses adaptive volume coefficients, driven by a set of difference equations and Boolean algebra, to transition the states of forest stands from one planning period to the next. We provide a mathematical description of Model 4, show how maximum harvest opening size constraints can be incorporated in the new model and present some computational results

4 - Roll Assortment Planning Under Stochastic Demand and Capacity Constraint
Satyaveer S. Chauhan, Concordia University, Montreal, QC, Canada, satyaveer.chauhan@concordia.ca, Anjali Awasthi, Alain Martel, Sophie D'Amours

A roll can produce several paper products, however multiple parent rolls are used to balance the inventory holding and trim related costs. The problem becomes complex if processing capacity is limited and demand is stochastic. In this we present a mathematical programming based approach to tackle such problem.

■ TB42

42- North 227 C- CC

Urban Mobility and Land Use

Sponsor: Transportation Science & Logistics/ Urban Transportation
Sponsored Session

Chair: Yueyue Fan, Associate Professor, University of California, Department of Civil & Environmental Eng., Davis, CA, 95616, United States of America, yyfan@ucdavis.edu

1 - An Integer Programming Model for Controlling Urban Sprawl
Piyush Kumar, University of Texas at Arlington, 416 Yates St., Arlington, TX, United States of America, piyush.kumar@mavs.uta.edu, Jay Rosenberger

Sprawl has a detrimental effect on quality of life and the environment. Ewing et al. (2002) defined measures of sprawl in the present urban structure. In this research, we develop an integer programming model to optimize land usage subject to sprawl constraints, which are based upon the sprawl measures. We describe heuristics and a Dantzig-Wolfe method to solve the model. Finally, we discuss topics of future research.

2 - Optimizing Stable Rides for Dynamic Ride-sharing Systems
Xing Wang, PhD Student, Georgia Tech, 765 Ferst Dr, Atlanta, GA, 30332, United States of America, xwang35@gatech.edu, Alan Erera

Smartphone technology enables dynamic ride-sharing systems. Matching drivers and riders plays a key role in solving ride-sharing problems. A system-wide optimal solution aimed at minimizing the external societal costs may not necessarily optimize the cost-savings of each individual participant. We develop optimization based algorithms to balance the system's benefits and users' satisfaction. We evaluate our methods by presenting a simulation study based on travel demand data from Atlanta.

3 - A Hierarchical Urban Traffic Control Problem
Paul Hoffer, University of Arizona, Tucson, AZ, United States of America, phoffer@email.arizona.edu, Yi-Chang Chiu

In this talk, we discuss a concept of hierarchical control of urban vehicular traffic. The concept starts from partitioning the entire networks into controllable sub-areas. The upper-level problem aims to divert traffic among different sub-areas. The lower problem aims to optimize local traffic within the sub-area. Various methods in network partitioning, upper- and lower-level flow control strategies are presented and discussed.

■ TB43

43- North 228 A- CC

Railway Capacity Analysis

Sponsor: Railway Applications

Sponsored Session

Chair: Matthew Petering, Assistant Professor, University of Wisconsin—Milwaukee, P.O. Box 784, EMS E367, Milwaukee, WI, 53201, United States of America, mattpete@uwm.edu

1 - Incremental Capacity Expansion – Heavier Loads, Faster Empties and Quicker Meets

Hans Boysen, Researcher, KTH Royal Institute of Technology, Department of Transport Science, Traffic and Logistics, Stockholm, SE-10044, Sweden, heboysen@kth.se

To meet growing demand, a study is being done on measures to raise transportation capacity, including increased tonnage per loaded train using the existing locomotives, higher return speed for empty trains, and quicker meets. Results show that for a trailing tonnage increase of some 19 %, the longer loading, transit and unloading times would be more than recovered by raising the empty return speed by some 10 km/h. Simultaneous entry to meets will further raise capacity and reduce cycle time.

2 - Analyzing the Progression from Single to Double Track using Simulation Techniques

Samuel L. Sogin, Graduate Research Assistant, University of Illinois at Urbana-Champaign, 205 N Matthews B118, Urbana, IL, 61801, United States of America, ssogin2@illinois.edu

Much of the railway network is single track. Freight and passenger traffic is expected to increase requiring additional capacity. The funding for the complete second track may not be available all at once. This track may be phased in over time as funding becomes available. These analyses use simulation to define the operating characteristics of these hybrid track configurations. These results will facilitate the development of an optimal incremental upgrade model for capacity expansion.

3 - Mixed Integer Programming for Capacity Analysis of a Single Track Railway Part I: Two Train Types

Matthew Petering, Assistant Professor, University of Wisconsin—Milwaukee, P.O. Box 784, EMS E367, Milwaukee, WI, 53201, United States of America, mattpete@uwm.edu, Dietrich Bergmann, Mojtaba Heydar

We analyze the capacity of a single track, unidirectional rail line. A set of intermediate stations lies between an origin and destination with one siding at each station. Two train types–express and local–are dispatched from the origin. A mixed integer program is developed to measure the capacity of the railway. Constraints include a maximum total dwell time for the local train and headway considerations on the main line and in stations. Hundreds of problem instances are solved to optimality.

4 - Mixed Integer Programming for Capacity Analysis of a Single Track Railway Part II: Generalized Model

Mojtaba Heydar, PhD Candidate, University of Wisconsin—Milwaukee, P.O. Box 784, Milwaukee, WI, 53201, United States of America, mheydar@uwm.edu, Matthew Petering, Dietrich Bergmann

We present a generalized mixed integer program for analyzing the capacity of a single track, unidirectional rail line. Our MIP model can handle (1) more than one siding per station, (2) more than two train types, and (3) different origins and destinations for each train type. Several heuristic and exact methods are employed in preliminary phases to properly set up the model, allowing CPLEX 11.2 to find optimal solutions to hundreds of large problem instances in a surprisingly short time.

■ TB44

44- North 228 B- CC

Supply Chain: Managing Disruptions

Contributed Session

Chair: Paul Cronin, University of Texas at Austin, 2110 Speedway Stop B6500, CBA 5.202, Austin, TX, 78712-1750, United States of America, paul.cronin@utexas.edu

1 - Retailer Competition under Supply Uncertainty

Shaoxuan Liu, Associate Professor, Antai College of Economics and Management, Shanghai Jiao Tong University, 535 Fa Hua Zhen Rd., Shanghai, China, liusx@sjtu.edu.cn, Rick So, Fuqiang Zhang

We use a game-theoretical framework to study the impact of supply uncertainty on the joint marketing and inventory decisions between two competing retailers. We derive some analytical results that provide managerial insights on the equilibrium behavior of these joint decisions and the corresponding profitability of the two retailers.

2 - Effect of Process Flexibility in Mitigating Supply Chain Disruptions

Nezir Aydin, PhD Candidate, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States of America, aydin@wayne.edu, Alper Murat

We study the value of process flexibility in mitigating supply chain disruptions. A location-allocation problem is considered where potential facilities are subject to failure and facility-product allocation decisions represent degree of process flexibility. We consider two scenarios: balanced and unbalanced demand and capacity. Analytic results and extensive computational results show that value of flexibility depends on demand and supply balance and number of facilities.

3 - Risk Sharing in a Coordinated Supply Chain under Considering Quality Fault

Yongfei Li, School of Management, Xiían Jiaotong University, No.28, Xianning West Road, Shaanxi, Xi'An, 710049, China, lyfking2000@163.com, Qin Su

Based on Stackelberg game, this paper presents the optimal profit, optimal order quantity and risk sharing problem in a coordinated supply chain under considering quality fault when the supply chain is consisted by one supplier and one retailer around a single product within one period. The risk sharing of all parties in the coordinated supply chain are all positively correlated with the quality fault rate, scrap rate, wholesale price and retail price but non-correlated with the return policy.

4 - A Decision-Theoretic Framework for Demand Estimation and Inventory Planning during Hurricanes

Paul Cronin, University of Texas at Austin, 2110 Speedway Stop B6500, CBA 5.202, Austin, TX, 78712-1750, United States of America, paul.cronin@utexas.edu, Douglas Morrice, John Butler

As a hurricane nears the Gulf coast, consumers stock up to prepare for the storm and its aftermath. Predicting consumer demand (and thus inventory allocation and planning) is a central challenge for retailers in the region. An econometric model estimates demand using actual purchase data and the residuals are used to explain consumer behavior using NOAA data from 2002-2008. A stochastic inventory allocation model investigates the timing and level of inventory allocation for future storms.

■ TB45

45- North 229 A- CC

Panel Discussion: Time Management

Sponsor: Junior Faculty Interest Group

Sponsored Session

Chair: Shengfan Zhang, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, shengfan@mail.uark.edu

1 - Panel Discussion: Effective Strategies for Time Management and Work-life Balance

Moderator: Shengfan Zhang, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, shengfan@mail.uark.edu, Panelists: Brian Denton, Mark Lewis, Laura McLay, Kathryn Stecke, Ariela Sofer

In this discussion, panelists from engineering and business departments will share their effective strategies for time management and work-life balance. Panelists have experiences in winning NSF CAREER proposals, publishing in prestigious journals, mentoring a large research group, and serving at various committees while balancing and enjoying life.

■ TB46

46- North 229 B- CC

Disaster and Emergency Response II

Contributed Session

Chair: Soumia Ichoua, Associate Professor, Embry-Riddle Aeronautical University, Department of Business Administration, Daytona Beach, FL, United States of America, ichouas@erau.edu

1 - Inventory and Routing Problem for Humanitarian Reliefs
Hoda Atef Yekta, Amirkabir University of Technology (Tehran Polytechnic), Hafez St., Tehran, Iran, h.atefyekta@gmail.com, Hamed Ahangari

This research proposed a mixed integer programming model to schedule the humanitarian relief vehicles after disaster. The objective of the model is finding the shortest routes for vehicles while considering the constraints of inventory at the main warehouse and small distributers besides considering the other conditions of disaster area.

2 - A Markov Decision Model for Capacity-adjustment in Humanitarian Logistics Operations
Marco Serrato, Dr., Tecnologico de Monterrey, E. Monroy Cardenas 2000. San Antonio Bue, Toluca, 50110, Mexico, mserrato@itesm.mx, Jose Holguin-Veras, Raul Heras

The management of crisis situations through humanitarian aid operations has historically been identified as a critical issue. Unexpected events pose major challenges to the organizations involved in the delivery of critical supplies to an impacted site. A Markov decision model is developed through this research, which supports capacity-adjustment decisions for a point of distribution at the impacted site. The model allows the identification of an optimal monotone nondecreasing policy.

3 - Mitigation Strategies in Disaster and Crisis Management
Sushil Gupta, Professor, Florida International University, RB 250, 11200 SW 8th Street, Miami, FL, 33199, United States of America, poms@fiu.edu, Martin Starr

We demonstrate the strategic importance of mitigation in disaster and crisis management where the responders must cope with needs of people buried, injured, starving, thirsty and requiring shelter. Crisis management anticipates needs before they arise. From a systems perspective, the anticipation of catastrophes can sometimes result in mitigation of damage. Under some circumstances, it can even prevent the catastrophe from occurring.

4 - A Stochastic Phase-dependent Approach for the Prepositioning Problem in Humanitarian Supply Chains
Soumia Ichoua, Associate Professor, Embry-Riddle Aeronautical University, Department of Business Administration, Daytona Beach, FL, United States of America, ichouas@erau.edu, Walid Klibi, Alain Martel

We propose a scenario based approach to tackle the strategic problem of prepositioning emergency supplies. First, the disaster process is modeled using a risk modeling approach and a Monte Carlo procedure is derived to generate a set of plausible disaster scenarios. Second, the problem is formulated as a two-stage stochastic programming model and solved using an SAA method based on the proposed Monte Carlo procedure. Experiments are conducted on a test case inspired from real-world data.

5 - Location of Volunteer Fire Departments in an Urban Region
Brigitte Werners, Prof. Dr., Ruhr-University Bochum, Institute of Management, Fac of Management and Economics, Bochum, 44780, Germany, or@rub.de, Dirk Degel

Timeliness is the most important objective to reflect the quality of emergency services such as firefighting systems. In Germany, a well established system of volunteer fire brigades supports municipal fire departments. To optimize number and locations of volunteer fire departments multi-criteria methods are used to determine solutions for an urban area. Considered objectives are minimizing average travel time and longest travel time which both are in conflict with minimizing costs.

■ TB47

47- North 230- CC

Dynamic Traffic Assignment II - System Optimal Modeling

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Tao Yao, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, taoyao@psu.edu

1 - Generalized Point Queue Model (GPQM) and Application to System Optimal Dynamic Traffic Assignment (SO-DTA)
Tao Yao, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, taoyao@psu.edu, Terry Friesz, Ke Han

The Vickrey's point queue model involves an ODE with discontinuous right hand side, which makes it difficult to analyze and compute in continuous-time. We present a partial differential equation formulation of Vickrey's model. This formulation leads to an explicit solution of the ODE and a new computational method. We will also discuss the application of the GPQM to SO-DTA problems.

2 - Modeling of Dynamic System Optimal in Continuous-Time
Rui Ma, Rensselaer Polytechnic Institute, Troy, NY, United States of America, mar2@rpi.edu, Jeff Ban, Jong-Shi Pang

We propose an optimal control model for dynamic system optimal problem in continuous time. The model integrates the double queue formulation for queue dynamics that captures the queue capacity and inflow/exit flow capacities.

3 - On the Path Marginal Cost of System Optimal Dynamic Traffic Assignment Problem
Hong Zheng, Research Assistant Professor, University of Arizona, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, hzheng@email.arizona.edu, Xianbiao Hu, Yi-Chang Chiu

In this talk we investigate and show a method to compute path marginal cost, on a general network with diversion points, for the system optimal dynamic traffic assignment (SO-DTA) problem. The method offers an effective way to solving the SO-DTA problem. Some preliminary numerical results are presented.

4 - Dynamic System Optimal for Multiple O-D Networks Embedding Cell Transmission Model
Kien Doan, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, dtkien@gmail.com, Satish Ukkusuri

In this paper, the route-choice System Optimal Dynamic Traffic Assignment (SO-DTA) problem for general network of multiple O-D pairs is formulated. We incorporate the Path-based Cell Transmission Model as the underlying network loading procedure to propagate traffic from different paths of different O-Ds. This model guarantees that the traffic moves without holding-back phenomenon. Since the general optimization solvers are not able to solve the SO-DTA problem for medium-size network, we propose a heuristic algorithm based on method of successive average which can solve the SO-DTA problem for general networks. Extensive experiment results will be shown to illustrate the benefits of the proposed model and algorithm.

■ TB48

48- North 231 A- CC

Facility Logistics I

Sponsor: Transportation Science & Logistics/ Facility Logistics

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, ME 3258, Madison, WI, United States of America, ananth@engr.wisc.edu

1 - Performance Analysis of Zone-picking Systems
Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, iadan@tue.nl, Jelmer van der Gaast, René De Koster, Jacques Resing

We consider zone picking systems, where totes travel between zones to collect items. If a tote tries to enter a fully occupied zone, then the tote is blocked and recirculated in the network. This system is approximated by a closed multi-class queueing network with jump-over blocking. We develop an iterative algorithm based on mean value analysis to evaluate blocking probabilities and performance characteristics such as utilization and throughput.

2 - An Axiomatic and Teachable Warehouse Design Method
Leon McGinnis, Professor Emeritus, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, leon.mcginnis@isye.gatech.edu

Distinguishing function from embodiment is the key to developing a teachable warehouse design method that incorporates both analytic and empirical knowledge and is a platform for creating computer aided warehouse design tools. The method will be described and illustrated with a case from the literature.

3 - Solving the Unequal Area Facility Layout Problem using Linear Programming Based Genetic Algorithm
Sadan Kulturel-Konak, Associate Professor, Pennsylvania State Berks, Tulpehocken Rd. P.O. Box 7009, Reading, PA, United States of America, sadan@psu.edu, Abdulah Konak

In this study, a hybrid Genetic Algorithm (GA)/Linear Programming (LP) approach is proposed to solve the FLP on the continuous plane with unequal-area departments. Once relative department positions are set, actual department locations and shapes are determined by solving an LP problem. Finally, the output of the LP solution is incorporated into the encoding scheme of the GA. Numerical results show that the proposed approach is very promising.

4 - Modeling Overlapping Container Terminal Operations
René De Koster, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, Netherlands, rkoster@rsm.nl, Debjit Roy

We develop new integrated stochastic models for analyzing the performance of container terminals with overlapping loading and unloading operations. These models capture the complex interactions among the quayside, vehicle, and stackside processes, and provide system design insights.

■ TB49

49- North 231 B- CC

Planning and Routing in City Logistics

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Teodor Crainic, Professor, ESG UQAM and CIRRELT, Pavillon André-Aisenstadt, 2920, Chemin de la Tour, Montreal, QC, H3T 1J4, Canada, TeodorGabriel.Crainic@cirrelt.ca

1 - Efficient Routing on Large-scale Dynamic Networks under ITS using Hierarchical Communities
Mahyar Movahednejad, PhD Candidate, Wayne State University, Manufacturing Engineering Building, 4815 Fourth St., Detroit, MI, 48202, United States of America, mahyar@wayne.edu, Ratna Babu Chinnam

We employ an emerging concept in analyzing complex networks called "community structure detection" to capture traffic network dynamics in the form of hierarchical community-based representations of road networks. We then develop hierarchical routing algorithms to the extracted hierarchical network. We demonstrate the performance of the proposed approaches using actual road network data from Southeast Michigan.

2 - Urban Route Planning in the Management of Delivery Time Windows
Jan Fabian Ehmke, University of Braunschweig, Mühlenpfordtstraflle 23, Braunschweig, 38106, Germany, j-f.ehmke@tu-bs.de, Ann M. Campbell

Our goal is to improve the efficiency and reliability of last mile deliveries in urban areas. We present a computational framework, which considers time-dependent travel times in route planning of urban delivery tours. In particular, we investigate to which extent the design and the selection of delivery time windows might benefit from additional traffic information being available from telematics-based data collection technology.

3 - Innovative Services in City Logistics
Luce Brotcorne, INRIA, 40 Avenue Halley-Bat A, Parc Scientifique de la Haute Borne, Villeneuve D'Ascq, 59650, France, luce.brotcorne@inria.fr, Alexandre Huart, Frederic Semet

Most providers in city logistics have transportation and storage capacities exceeding what is effectively used. To better meet the offer, an innovative strategy for an alliance of logistic providers is to develop a collaborative approach based on the pooling of residual capacities resulting of their activities. We propose a model for routing demands over a network defined by logistic services and show how innovative services can be modeled. Numerical results are presented.

4 - The Time-dependent Multi-zone Multi-trip Vehicle Routing Problem with Time Windows
Phuong Khanh Nguyen, University of Montreal and CIRRELT, 2920 Chemin de la Tour, Montreal, QC, Canada, phuong@crt.umontreal.ca, Teodor Crainic, Michel Toulouse

The Time-dependent Multi-zone Multi-trip Vehicle Routing Problem with Time Windows (TMZT-VRPTW), a problem arising from the second tier of the two-tiered city logistic system described by (Crainic et al., 2009), is an extension of the VRPTW involving both designing and assigning routes to vehicles within the time synchronization restrictions. We present a new approach which is able to improve the best known solutions of all currently published results.

■ TB50

50- North 231 C- CC

Modeling and Analyzing Military Operations and Systems I

Sponsor: Military Applications

Sponsored Session

Chair: Chris Arney, Professor, United States Military Academy, Department of Mathematics, West Point, NY, 10996, United States of America, david.arney@usma.edu

1 - Network Cooperation Models for Irregular Warfare
Chris Arney, Professor, United States Military Academy, Department of Mathematics, West Point, NY, 10996, United States of America, david.arney@usma.edu, Kathryn Coronges

We present a complexity-based modeling framework that merges network science and social network analysis with recent results in cooperative game theory and information science to simulate, design, and understand military systems and doctrine. This framework embraces the complexity of understanding the challenging issues associated with complex adaptive systems and military operations. We apply our framework to scenarios and important military operational issues.

2 - Packing Steiner Trees
Eric Thornburg, Department of Mathematical Sciences, United States Military Academy, 646 Swift Road, West Point, NY, 10996, United States of America, eric.thornburg@usma.edu, William Pulleyblank, Steven Horton

VLSI design requires efficient packing of Steiner trees linking components on a chip. We describe an algorithm for optimal generation and packing of Steiner trees in a rectilinear grid. "Good" Steiner trees are created by a cutting plane approach using Steiner multi-cuts. We use Benders' decomposition to pack these Steiner trees, while satisfying congestion constraints. We also discuss other applications of this approach.

3 - Social Media and its Future in the Army
Evan Szablowski, United States Military Academy, Department of Mathematics, West Point, NY, 10996, United States of America, evanszab@gmail.com, Kathryn Coronges, Chris Arney, Hilary Fletcher

Social Media (SM) have taken a central role in transforming the way people communicate and how we think about social engagement. Young generations have grown up enmeshed in SM, producing expectations about access to information. Young soldiers expect the military to be at the frontier of this revolution. We analyze how younger generations use SM and show how the military can benefit by applying the similar concepts to communication.

■ TB51

51- North 232 A- CC

Applying Analytics to Support Condition Based Maintenance Decisions

Sponsor: Military Applications

Sponsored Session

Chair: Norm Reitter, Advisor, Information Technology, Concurrent Technologies Corporation, 329, 44th Street, Pittsburgh, PA, 15201, United States of America, reittern@ctc.com

1 - Using Sensor Data and Reliability Analysis to Improve Aircraft Component Failure Predictions
Johnathon Dulin, Concurrent Technologies Corporation, 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com, Alan Moses

Sensor data use in Army Aviation is generally limited to determining when a component exceeds a maintenance threshold. With a wealth of data available from onboard sensors, those data could better support maintenance and sustainment decisions if used effectively. We use sensor data and operational profiles to project when a component will cross its thresholds, considering component and supply chain uncertainty to predict when a component will require replacement and to trigger a demand signal.

2 - Using Large Scale Experiments and a CBM Simulation for Driving Effectiveness in the Supply Chain

Dan Widdis, Fellow, Principal Operations Research Analyst, Concurrent Technologies Corporation, 5897 Castleberry Peak Ave., Las Vegas, NV, 89131, United States of America, widdisd@ctc.com

Component sensor data can be used both for maintenance decisions and to forecast future demand. Aggregated at the enterprise level, demand forecasts enable decision makers to prioritize orders, reposition stocks, and replenish stores in advance of anticipated future demands. Because of the large range of variables involved in these decisions and the potential interactive effects, we employ efficient experimental designs to extract the maximum information from a limited number of simulation runs.

3 - Using CBM Data for Army Aviation Fleet Sparing Optimization

Marshall Smith, Technical Director of Energy Systems, Clockwork Solutions, 115 Wild Basin Rd S, Suite 301, Austin, TX, 78746, United States of America, marshall.smith@clockwork-solutions.com

Maximum value of a CBM program in Army Aviation is realized when that program is tied to the Supply Chain supporting the fleet. We utilize the results of prognostic analytics at the component and tail number level to initialize all tail numbers within a fleet so that supply chain managers can optimize sparing strategies that best address the expected demands throughout the fleet, from the wholesale level down to the unit level.

■ TB52

52- North 232 B- CC

Modeling Natural Gas Markets with OR Techniques

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Olivier Massol, Assistant Professor, IFP School, 228-232 Avenue Bonaparte, Rueil-Malmaison, 92852, France, olivier.massol@ifpen.fr

1 - Natural Gas Price Forecasting via Selective Support Vector Regression

Mohammad H. Poursaeidi, University of Houston, E 209 Engineering Building, Houston, TX, United States of America, mhpoursaeidi@uh.edu, Erhun Kundakcioglu, Andrea Viacaba

Natural gas is one of the most abundant sources of energy in the US. An accurate natural gas price prediction model is useful in the industry due to its economical impacts. The purpose of this research is to analyze historical information on the variables that potentially have a high impact on the supply and demand for natural gas, as well as the price. This analysis is conducted using a novel data-mining algorithm that is capable of simultaneously removing noise and performing regression.

2 - Joining the CCS Club! Insights from a Northwest European CO2 Pipeline Project

Stephane Tchung-Ming, Research Fellow, IFP Energies Nouvelles, 1-4 Avenue de Bois Preau, Rueil-Malmaison, 92852, France, stephane.tchung-ming@ifpen.fr, Olivier Massol

The large-scale diffusion of Carbon Capture and Storage (CCS) technologies imposes the construction of a sizeable pipeline infrastructure. We analyze the conditions for a widespread adoption of CCS by a group of emitters using a common pipeline system. It clarifies how the regulatory constraints imposed to the pipeline operator influence the emitters' adoption. An application of this framework to the case of a European point-to-point pipeline is discussed. Policy recommendations are formulated.

3 - Cartelization in the Natural Gas Industry, a Model-based Analysis

Olivier Massol, Assistant Professor, IFP School, 228-232 Avenue Bonaparte, Rueil-Malmaison, 92852, France, olivier.massol@ifpen.fr, Albert Banal-Estañol, Steven Gabriel

We investigate the stability of a cartel gathering the main natural gas exporting countries. Our analysis uses a deterministic, discrete-time, finite-horizon oligopoly model capable to determine investment and production equilibrium strategies, in a setting where the demand's specification takes into consideration the adjustment dynamics of current consumption to both present and past prices. We assume a dynamic hierarchical pricing model á la Stackelberg with a feedback information structure.

4 - Analyzing Effect of U.S. Natural Gas Exports on the Global Gas Markets

Steven Gabriel, University of Maryland, College Park, MD, United States of America, sgabriel@umd.edu, Seksun Moryade, Hakob Avetisyan, Vincent Briat

U.S. natural gas companies aim to export natural gas to global markets because of growing domestic natural gas supply and relatively low prices compared to other foreign natural gas markets. In this presentation, we investigate effects of exporting U.S. natural gas to Asia and Europe. We also take into consideration the effects of uncertainty of shale gas production in China in addition to carbon policy scenarios as part of University of Maryland's World Gas Model.

■ TB53

53- North 232 C- CC

Stochastic Hydro-Thermal Scheduling II

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Steffen Rebennack, Assistant Professor of Operations Research, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, srebenna@mines.edu

Co-Chair: Timo Lohmann, PhD Student, Colorado School of Mines, 816 15th Street, Golden, CO, 80401, United States of America, tlohmann@mines.edu

1 - Stochastic Dual Dynamic Programming with CVaR Risk Constraints Applied to Hydrothermal Scheduling

Luiz Carlos Costa Jr, PSR, Praia de Botafogo 228/1701-A, Rio de Janeiro, RJ, 22250-145, Brazil, luizcarlos@psr-inc.com, Mario Veiga Pereira, Sèrgio Granville, Nora Campodonico, Marcia Fampa

In this talk we present an extension of the SDDP algorithm to incorporate CVaR constraints on supply reliability. We show that these constraints can be represented as piecewise linear penalties on the energy not supplied, and develop an efficient algorithm to calculate the segment coefficients. The methodology will be illustrated with a realistic stochastic hydrothermal scheduling problem.

2 - A Direct CVaR Approach with a Detailed Representation of Critical Scenarios for the SDDP Method Applied to Hydrothermal Generation Planning

Débora D. J. Penna, Researcher, CEPEL-Brazilian Electric Energy Research Center, Avenida Horacio Macedo, 354, Ilha do Fundão-Cidade Universitária, Rio de Janeiro, RJ, 22941-911, Brazil, debora@cepel.br, Maria Elvira Maceira, Andre Luiz Diniz

We present an alternative CVaR approach for the stochastic dual dynamic programming approach, with no additional state variables and a more intuitive recourse function, as compared to previous works. Aiming to improve the risk measure, we also perform a detailed representation of the tail of the distribution function by employing multivariate statistical techniques. Numerical results and discussion are presented in the multi-stage generation planning problem of the large-scale Brazilian system.

3 - Inflow Forecasting Models for Hydrothermal Scheduling

Timo Lohmann, PhD Student, Colorado School of Mines, 816 15th Street, Golden, CO, 80401, United States of America, tlohmann@mines.edu, Amanda Hering, Steffen Rebennack

Inflow forecasting is an important part of hydrothermal scheduling under uncertainty. Algorithms such as the stochastic dual dynamic programming method (SDDP) require the forecasting model to be linear in order to maintain convexity in the future cost function. This limits the type of forecasting models and thus mostly simple methods such as linear autoregressive models are used in practice. We discuss these approaches and compare them to more advanced methods.

■ TB55

55- Regency Ballroom B - Hyatt

Undergraduate Operations Research Prize I

Cluster: Undergraduate Operations Research Prize

Invited Session

Chair: Feryal Erhun, Stanford University, Stanford, CA, United States of America, ferhun@stanford.edu

1 - Detecting Covert Members of Terrorist Networks

Alice Paul, Harvey Mudd College, Claremont, CA, United States of America, apaul@hmc.edu

Increasing the amount of communication through a key leader increases the likelihood of detection. If we model a covert organization as a social network where edges represent communication between members, we want to determine the subset of members to remove that maximizes the amount of communication through the leader. We present an optimization and its decomposition for this problem. We focus on structural characteristics of vertices and subsets that increase communication.

2 - Wind Turbine Offloading Strategy Optimization for GE Energy
Jacmara Ching, Georgia Institute of Technology, Atlanta, GA, United States of America, jkcs3@gatech.edu, Santiago Diaz, Antonio Elosua, Oscar Harasic, Yonatan Mintz, Mario Solares Nassar

We created two tools to assist GE Energy with the wind turbine delivery and offloading processes. The first is a forecasting tool, which uses regression equations to forecast the arrivals of components at wind farms. The second is a sequencing tool, which utilizes a heuristic to find the optimal allocation of cranes at a given wind farm site. GE Energy can expect savings of $1.9 million from the implementation of these tools, and GE Energy's customers may also expect savings up to this amount.

3 - Optimization-based Approaches to Assigning Sorority Sisters to Rooms and Roommates
Xing Li, University of Michigan, Ann Arbor, MI, United States of America, xingl@umich.edu, Zixiao Chen, Rachel Froelich, Jon Lee, Mark Daskin

Every semester, the Alpha Phi Sorority University of Michigan Chapter needs to assign enrolled sisters to different capacity apartments of the sorority in considering each individual's room as well as roommate preference. We address this issue by using mixed-integer linear programming and heuristic algorithms to make optimal level assignment decisions that can be repeated every semester.

■ TB56

56- Curtis A- Hyatt

Joint Session TMS/NPD: Technology Management Section Best Paper Winner Presentation

Sponsor: Technology Management & New Product Development

Sponsored Session

Chair: Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu

1 - Technology Management Section Best Paper Winner Presentation
Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu

Please join us to award the first annual TMS Best Paper Award. This is for the best paper from 2007 in the TMS domain in an INFORMS journal. The Winner and Runner-ups will present their work building on their seminal papers and special-guest discussants will comment.

■ TB57

57- Curtis B- Hyatt

Applications of Stochastic Control to Finance

Sponsor: Applied Probability

Sponsored Session

Chair: Stathis Tompaidis, University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, stathis.tompaidis@mccombs.utexas.edu

1 - Algorithmic Trading: Matching the Volume Weighted Average Price
Daniel Mitchell, University of Texas, McCombs School of Business, 1 University Station, B6000, Austin, TX, 78712, United States of America, Daniel.Mitchell@phd.mccombs.utexas.edu, Jedrzej Bialkowski, Stathis Tompaidis

We consider a model in which a trader seeks to minimize the deviation between his volume weighted average price and the market's, over a day for one stock. The model incorporates both random fluctuations in volume and market impact of trading. We find some heuristic trading strategies as well as lower bounds on the minimal expected deviation. The model is calibrated to actual market data and we compare amongst the heuristic strategies using this real data.

2 - G-Brownian Motion and Optimal Stopping
Xin Guo, University of California-Berkeley, Berkeley, CA, United States of America, xinguo@ieor.berkeley.edu

We consider optimal stopping problems under the G-B.M. framework. Well-posedness of the problem and characterization of the solution are discussed. Based on joint work with Chen Pan and Shige Peng.

3 - The Test Region Iterative Contraction (TRIC) Method for Solving Stochastic Control Problems
Chunyu Yang, Assistant Professor, BI Norwegian Business School, Oslo, Norway, yangchy@gmail.com, Stathis Tompaidis

We introduce the test region iterative contraction (TRIC) method to solve high-dimensional discrete-time stochastic control problems under general constraints. The method combines dynamic programming and functional approximations of conditional expectations, and iteratively shrinks the approximation region around the optimal solution. We apply the method to two Finance applications: a) dynamic portfolio choice with constraints; b) dynamic portfolio choice with capital gain taxation.

4 - American Options: Upper Bounds on the Cost of Delayed Exercise
Arun Chockalingam, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, A.Chockalingam@tue.nl, Haolin Feng

In this talk, we consider the cost of delaying the exercise of American options. Leveraging on the moving boundary approach to American option pricing, we characterize upper bounds on this cost in terms of only the option's intrinsic value and the value function associated with delayed exercise for a variety of market models from the simple Black-Scholes model to complex Stochastic Volatility Jump-diffusion models. We present illustrations of these bounds for both put and call options.

■ TB58

58- Phoenix East- Hyatt

Data-driven Decisions: Methods and Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Gah-Yi Vahn, Assistant Professor, London Business School, Regent's Park, London, United Kingdom, gvahn@london.edu

1 - Approximating the Crowd with Crowd Sense
Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Seyda Ertekin, Haym Hirsh

We give an algorithm for "approximating the crowd," which is to find the crowd's majority vote on an item without paying all of them.

2 - Automated Risk Predictions for Clinical Decision Making
Mohsen Bayati, Stanford University, Stanford, CA, United States of America, bayati@stanford.edu, Mark Braverman, Justin Gatewood, Eric Horvitz

We present results on applications of automated machine learning methods in healthcare.

3 - Operational Statistics for the Risk-averse Newsvendor Problem
Mengshi Lu, University of California, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States of America, mengshi@berkeley.edu, George Shanthikumar, Z. Max Shen

We consider the risk-averse newsvendor problem under the conditional value-at-risk criterion with unknown demand parameter. We use the operational statistics approach to integrate parameter estimation and optimization, and show that operational statistics achieves higher expected utility than the separated approach. We also found that using operational statistics brings larger benefit when the risk associated with demand uncertainty and demand sampling is higher.

4 - Performance-based Regularization for Data-driven Optimization
Gah-Yi Vahn, Assistant Professor, London Business School, Regent's Park, London, United Kingdom, gvahn@london.edu, Noureddine El Karoui, Andrew Lim

We present an extension of the regularization technique that is currently popular in statistics and machine learning. We apply this to mean-CVaR portfolio optimization to reduce the estimation risk of the performance.

■ TB59

59- Phoenix West- Hyatt

Queues with Abandonments

Sponsor: Applied Probability

Sponsored Session

Chair: John Hasenbein, Associate Professor, University of Texas at Austin, 204 E. Dean Keeton St. Stop C2200, Austin, TX, 78712, United States of America, jhas@mail.utexas.edu

1 - Comparing Ticket and Standard Queues in Heavy Traffic

Otis Jennings, Visiting Associate Professor, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, otisbjennings@gmail.com, Jamol Pender

A new customer to a ticket queue is offered a number, indicating order of service, and is told the number currently in service. The customer balks or joins. Even if he takes a ticket, he may abandon later, an event unbeknownst to the server until service would have begun. We use limit theory to compare ticket and standard queues, proving the two processes converge together to the same limit. We conclude that for balanced systems with patient customers, the approaches are relatively identical.

2 - Mean and Variance Control of Dynamic Rate Multiserver Queues with Abandonment

Jamol Pender, Graduate Student, Princeton University, Sherrerd Hall Princeton University, Princeton, NJ, 08540, United States of America, jpender@princeton.edu, William Massey

We derive the optimal staffing schedule for a dynamic rate multi-server queue with abandonment where we want our profit to have a minimal amount of risk. To this end we consider optimal staffing of our multiserver queue with the fluid mean, but also the diffusion variance. Our analysis yields that the optimal staffing level is the solution to a fixed point equation. We also compare our staffing schedule to more well known staffing procedures such as square root staffing.

3 - Dynamic Scheduling of a GI/GI/1+GI Queue with Many Customer Classes

Jeunghyun Kim, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, jeunghyun.kim.2015@marshall.usc.edu, Amy Ward

We consider a dynamic scheduling problem for a GI/GI/1+GI queue with many customer classes in which there is a class-dependent abandonment cost. The objective is to minimize average cost by dynamically choosing which class the server should next serve. We formulate and solve an approximating Brownian control problem with non-linear drift that incorporates the entire abandonment distribution of each customer class, and then interpret the solution as a scheduling control in the original problem.

4 - A Time-dependent Study of Markovian Queues with Balking and Reneging

Brian Fralix, Assistant Professor, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States of America, bfralix@clemson.edu

We study the transient behavior of a birth-death process, whose birth and death rates are decreasing and increasing, respectively, with respect to the state index. Such processes can be used to model Markovian systems where customers are allowed to either balk or renege. Our results are derived by relating this birth-death process to a special type of queueing system, whose queue-length process is equal in distribution to the original birth-death process.

■ TB60

60- Remington- Hyatt

Airport Capacity Frontier Analysis: Current Methods, Tools and Findings: Part II

Sponsor: Aviation Applications

Sponsored Session

Chair: Dipasis Bhadra, Senior Economist, USDOT/FAA, 800 Independence Avenue, Washington, DC, DC, 20009, United States of America, dipasis.bhadra@faa.gov

1 - Airport Capacity using Non-parametric Methods; An Application to JFK Airport

Dipasis Bhadra, Senior Economist, USDOT/FAA, 800 Independence Avenue, Washington, DC, DC, 20009, United States of America, dipasis.bhadra@faa.gov, Steve Stroiney, Michael Carpenter, Yu Zhang

As air traffic returns to its pre-recession levels, estimation of airport capacity for efficient planning of landing and takeoff and mitigation of congestion-induced delays, especially at nation's busier airports, have become critical once again. Approaching representative airport's capacity, however, in parametric fashion (i.e., analytic and numerical methods) provides an abstraction that, in many cases, may not be equivalent to tactical and the observed capacity. Using ASDE-X and combined with other publicly available data, we present an analytical and non-parametric empirical framework to estimate and project airport capacity that takes into account dependencies of runways to gate, taxiways and movement areas and airport systems; observed aircraft mix, types of queuing and other ATM requirements, weather conditions and runway characteristics.

2 - Airport Capacity Assessment using Advanced Econometrics Models

Yu Zhang, University of South Florida, Civil and Environmental Engineering Dept, 4202 East Fowler Ave., Tampa, FL, 33620, United States of America, yuzhang@usf.edu

Airport capacity varies with many factors, to name a few, the configuration of runways, the fleet mix of the flights, weather condition. It also show different values when controllers trade off arrival and departure capacities to accommodate imbalanced demand in air traffic flow management. This study applies a combined Tobit regression model and Vector Autoregression Model to analyze the airport capacity and understand the incremental effects from NextGen programs deployed in recent years.

3 - Performance Evaluation of Alternative Continuous Descent Approaches

Jens Brunner, TUM School of Management, Arcisstrasse 21, LS Tech Dienstl Oper Mgmt, Munich, 80333, Germany, Jens.Brunner@wi.tum.de, Elsayed Elsayed

Continuous Descent Approach (CDA) is an important segment of an aircraft under the new NextGen air traffic system. We present a new formulation for the problem in order to minimize fuel consumption, emissions, noise and delays subject to assignment and separation constraints. We evaluate different CDA approaches, i.e. non/some/all aircrafts are CDA equipped. Computational results using real data show the efficiency of the modeling and the potential benefits of the CDA implementation.

4 - Safety Analysis of Centralized and De-centralized Automated Separation Concepts

John Shortle, Associate Professor, George Mason University, Dept. of Systems Engineering & OR, Fairfax, VA, 22030, United States of America, jshortle@gmu.edu

The Advanced Airspace Concept is a proposed concept involving centralized ground stations that automatically detect conflicts and provide resolutions to aircraft. In an alternate concept, governed by Autonomous Flight Rules, conflicts are detected and resolved in a de-centralized manner by individual aircraft. This talk explores high-level tradeoffs between such systems from a safety and reliability perspective, considering the failures of individual components and their potential impacts on safety.

■ TB61

61- Russell- Hyatt

Risk-Based Decision Making in Emergency Situations

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: Igor Linkov, US Army Engineer Research and Development Center, 696 Virginia Road, Concord, MA, 01742, United States of America, Igor.Linkov@usace.army.mil

1 - Valuation in Comparative LCA- Laundry Detergent Case Study

Valentina Prado, Graduate Research Assistant, Arizona State University, School of Sustainable Engineering, P.O. Box 875306, Tempe, AZ, 85287, United States of America, valentina.prado@asu.edu, Thomas Seager, Steven Tylock, Melissa Bernardo

To better manage environmental tradeoffs, weights and uncertainty, Stochastic multi-attribute analysis can be used in the valuation stage of comparative Life Cycle Assessment. Stochastic Multi-attribute analysis allows for uncertainty in the input parameters and explores a variety of weights simultaneously. Thus, it can help decision makers view the problem from multiple perspectives.

2 - Emergency Preparedness and Robustness to Uncertain Population and Workforce Behaviors
James Lambert, Research Associate Professor, University of Virginia, P.O. Box 400747, Charlottesville, VA, 22904, United States of America, lambert@virginia.edu, Jose Orlando Gomes, Elizabeth B. Connelly

Emergency managers can have mistaken assumptions of future population and workforce behaviors, in terms of their personal preparedness and their actions in emergencies. It is essential to understand the robustness of emergency plans to the variety of such behaviors. This talk will describe several case studies that model and evaluate the implications of population and workforce behaviors for risk management and emergency management in washington, DC, and Rio de Janeiro, Brazil.

3 - Use of Cognitive Modeling and Decision Analysis for Risk Management
Igor Linkov, US Army Engineer Research and Development Center, 696 Virginia Road, Concord, MA, 01742, United States of America, Igor.Linkov@usace.army.mil

Risk management challenges facing the US DOD require integrated approaches for knowledge acquisition and decision making. This paper illustrates the use of cognitive modeling and decision-analytical approaches to: (i) flood risk perception and management in US Army Corps of ENgineers; (ii) integration of cognitive models and multi-criteria decision analysis to address course of action selection in emergency settings.

■ TB62

62- Borein A- Hyatt

Auctions and Private Information

Cluster: Auctions

Invited Session

Chair: Dirk Bergemann, Douglass and Marian Campbell Professor of Economics, Yale University, 30, Hillhouse Avenue, New Haven, CT, 06520, United States of America, dirk.bergemann@yale.edu

1 - Extremal Information Structures of the First Price Auction
Dirk Bergemann, Douglass and Marian Campbell Professor of Economics, Yale University, 30, Hillhouse Avenue, New Haven, CT, 06520, United States of America, dirk.bergemann@yale.edu

We investigate the effect of information on the equilibrium behavior in first-price auctions. We solve for the Bayes correlated equilibria (BCE) of the first-price sealed-bid auction with private values. The set of BCE correspond to the set of pairs of information structures and Bayesian equilibria. We use the duality to back out information structures that support equilibria on the frontier of bidders' payoffs and revenue.

2 - Dynamic Revenue Maximization: A Continuous Time Approach
Philipp Strack, Department of Economics, University of Bonn, Bonn, Germany, philipp.strack@gmail.com, Dirk Bergemann

We characterize the profit-maximizing mechanism for repeatedly selling a non-durable good in continuous time. The valuation of each agent is private information and changes over time. At the time of contracting every agent privately observes his initial type which influences the evolution of his valuation process. In the profit-maximizing mechanism the allocation is distorted in favor of agents with high initial types.

3 - A New Approach to Correlation of Types in Bayesian Games
Luciano De Castro, Northwestern University, 2001 Sheridon Road, Evanston, IL, United States of America, l-decastro@kellogg.northwestern.edu

We propose a new approach to the model of correlation of types in Bayesian games, which also allows asymmetries. This is related to the idea that "beliefs do not determine preferences," and consists of modeling types with two explicit parts: one for preferences and another for beliefs. Building on this idea, we are able to provide the first pure strategy equilibrium existence for a general model of multi-unit auc- tions where types can be correlated.

4 - Rational Market Making with Probabilistic Knowledge
Abe Othman, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, Tuomas Sandholm

We study a market maker (MM) that has a prior over future world states and of how the price of a bet affects the probability that traders will accept it. Computing the optimal policy for a risk-neutral MM is simple, but challenging for a Kelly criterion MM. The former does not depend on the MM's state, while the latter depends intricately on time and state. Counterintuitively, the latter may offer bets that are myopically irrational with respect to her beliefs for the entire trading period.

■ TB63

63- Borein B- Hyatt

Behavioral Issues in Revenue Management

Sponsor: Behavioral Operations

Sponsored Session

Chair: Anton Ovchinnikov, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, Ovchinnikova@darden.virginia.edu

1 - Are Consumers Really Strategic? Experimental Study
Nikolay Osadchiy, Emory University, Atlanta, GA, United States of America, nikolay.osadchiy@emory.edu, Elliot Bendoly

Novel retail selling mechanisms involve a tradeoff between buying now vs later at a lower price. Recreating this setting in a laboratory, we observe a substantial fraction of subjects making decisions consistent with expected utility maximization. We find that subjects are particularly sensitive to whether the information about riskiness of the buy-later option is provided. Implications for revenue management are discussed.

2 - Consumer Loyalty, Strategic Behavior and Retailers' Dynamic Pricing Strategy: Theory Sand Experiments
Benny Mantin, University of Waterloo, Waterloo, ON, Canada, bmantin@uwaterloo.ca, Mirko Kremer, Anton Ovchinnikov

We investigate the impact of strategic consumer behavior and loyalty on the dynamic pricing strategies of competing retailers. We present both modeling results as well as the results of behavioral experiments in which subjects played as retailers in either a monopoly or duopoly environments. We compare subjects' decisions with the optimal model predictions and explain the effects of consumer loyalty and strategic behavior.

3 - Revenue Management with Lifetime Value Considerations
Anton Ovchinnikov, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, Ovchinnikova@darden.virginia.edu, Phil Pfeifer

We discuss the interaction between revenue management (RM) and customer relationship management (CRM) for a firm that operates in a customer retention situation but faces limited capacity. We present a dynamic programming model for how the firm balances investments in customer acquisition and retention, characterize the optimal policy and discuss how it changes depending on capacity limitations. We then contrast the modeling results with those of a behavioral experiment.

4 - Revenue Management at a Theater: Estimating Time of Ticket Purchases for Competing Customer Types
Necati Tereyagoglu, Assistant Professor, Georgia Institute of Technology, College of Management, Atlanta, GA, United States of America, necati.tereyagoglu@scheller.gatech.edu, Senthil Veeraraghavan, Peter Fader

Using individual level ticket sales and seat pricing data for a season of 21 concerts from a well-known arts organization, we test for the impact of discounts, show quality, performance date, promotions and time related characteristics on timing of the customer's purchases. We identify attractive ticket price tiers for subscribers and occasional buyers over time; and develop discount decisions that increase the revenues from each performance.

■ TB66

66- Ellis West- Hyatt

Data Mining Applications

Sponsor: Data Mining

Sponsored Session

Chair: Rong Duan, Principle Member of Tech Staff, AT&T Labs, 180 Park Ave, Florham Park, NJ, 07932, United States of America, rongduan@research.att.com

1 - Guess What I'm Doing Now!? An Analytic Engine For Detection of Mode-of-motion in Humans
Saeed Ghassemzadeh, Att Labs-Research, 180 Park Avenue, Florham Park, NJ, 07932, United States of America, saeedg@research.att.com

We introduce a generalized analytic engine which provides an algorithmic framework for detection of different modes-of-motion in human beings. The engine in turn can be used for detecting the deviation from the normal pattern and consequently correcting the anomalies. The algorithm was developed using the geriatric data from actual human subjects. The data was collected from ZigBEE enabled sensors embedded in the insoles of subject's slippers.

2 - Multivariate Copulas Model in Spatiotemporal Rare Event Detection

Rong Duan, Principle Member of Tech Staff, AT&T Labs, 180 Park Ave., Florham Park, NJ, 07932, United States of America, rongduan@research.att.com

Characterizing mobility network traffic is one of the most challenging tasks in mobility network planning and designing, especially when special events may occur in some areas. The spatial neighbour cell towers are highly correlated to each other, especially for the rare events. In this paper, we propose multivaraite Copulas model to detect the rare event clusters base on the spatial temporal data collected from mobility traffic data.

3 - Algebraic Graph Theoretic Approach for Data-driven Characterization of Nano-scale Surface Features

Prahalad Rao, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, prahalad.rao@okstate.edu, Satish Bukkapatnam, Zhenyu (James) Kong, Adam Fields, Ranga Komanduri

We present a spectral graph theoretic approach to characterize the morphology of surfaces finished using chemical-mechanical planarization (CMP) processing to near-optical quality.The proposed method is based on transforming the surface topography data into a fully connected graph, and extracting spectral properties of the Laplacian of the graph as features. The resulting Eigen analysis correlates (p ~ 80%) well with surface defect density.

■ TB67

67- Ellis East- Hyatt

Nanomanufacturing and Nanoinformatics II

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qiang Huang, Associate Professor, University of Southern California, 3715 McClintock Avenue, GER240, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Lijuan Xu, University of Southern California, 3715 McClintock Ave, GER 236, Los Angeles, CA, 90089, United States of America, lijuanxu@usc.edu

1 - Real Time Monitoring of Ultrasonic Cavitation in the Casting Process

Jianguo Wu, University of Wisconsin, 1513 University Avenue, ME3255, ISyE, Madison, 53706, United States of America, wu45@wisc.edu, Shiyu Zhou, Xiaochun Li

In the research of Metal-Matrix-Nano-Composite (MMNC), ultrasonic cavitation is usually used to disperse the added particles, degas the molten metal and refine the grains in the casting process. The objective of this research is to develop a new method for real time monitoring of ultrasonic cavitation and dispersion status in the casting process. By studying the cavitation noise, a new method is proposed to choose the cavitation power and control the cavitation time.

2 - Interaction-driven Physical Model Selection for SA-MOCVD Synthesis Process of Nanowires

Lijuan Xu, University of Southern California, 3715 McClintock Ave., GER 236, Los Angeles, CA, 90089, United States of America, lijuanxu@usc.edu, Qiang Huang

Numbers of physical models are proposed to describe the SA-MOCVD synthesis of nanowires without definite conclusion. In this paper, we incorporate interaction modeling to capture the local variability and develop an interaction-driven technique to select physical models to achieve better understanding of the process.

3 - A Stochastic Model for Estimating the Yield of ZnO Nanowire Growth Process

Haitao Liao, Associate Professor, University of Arizona, Tucson, AZ, 85721, United States of America, hliao@email.arizona.edu, Jingyan Dong, Yong Zhu

In this research, the growth process of ZnO nanowire arrays is studied. Based on the image data collected at different sites of a substrate, we develop a spatial compound Poisson model to estimate the yield of the growth process.

4 - Towards Coarse-Grained Potential Development in Atomistic Simulation for Nanostructure Synthesis

Satish Bukkapatnam, Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu, Changqing Cheng

A coarse-grained atomistic simulation approach is essential for investigating nanostructure synthesis process after the initial nucleation stages due to the high computational overhead involved in classical atomistic simulations (e.g., Monte Carlo). We developed the effective potentials for the coarse-grained models. Simulations show that the coarse-grained approach can save over 50% of Monte Carlo simulation time.

■ TB68

68- Suite 312- Hyatt

Asset Valuation and Risk Modeling

Sponsor: Financial Services Section

Sponsored Session

Chair: Jim Bander, National Manager, Decision Sciences / Risk Management, Toyota Financial Services, 3200 W Ray Rd, Chandler, AZ, 85226, United States of America, jim.bander@gmail.com

1 - Pricing Asian Options via Compound Gamma and Orthogonal Polynomials

Bacel Maddah, Associate Professor, American University of Beirut, Bliss Street, Beirut, Lebanon, bm05@aub.edu.lb, Hrayer Aprahamian, Joe Naoum-Sawaya

We develop two novel approximations (CG3 and CGn) for arithmetic Asian options. CG3 utilizes a compound Gamma distribution of the price average. It is calibrated by analytically matching the first three moments. CG3 outperforms many other approximations in the literature, on both accuracy and CPU time. CGn expands CG3 utilizing the concept of orthogonal polynomials from Physics, and matches n > 3 moments. CGn produces mostly near-"exact" results within one second.

2 - Constructing Investor Risk Preferences from Data

Vishal Gupta, Massachusetts Institute of Technology, 77 Massachusetts Ave., E40-135, Operations Research Center, Cambridge, MA, 02139, United States of America, vgupta1@mit.edu, Dimitris Bertsimas

Specifying risk preferences is critical to financial applications; yet, preferences are unobservable. Thus, we ask investors to self-describe as "conservative" or "risky." In this work we take a novel, data-driven perspective. Using ideas from inverse optimization, we construct distortion risk measures that are consistent with an investor's historical holdings. Computational evidence suggests the method is robust to data error and misspecification.

3 - Time-varying Beta and the Value Premium: Evidence from the Varying-coefficient Single-index Model

Chaojiang Wu, PhD Student, Department of Operations and Business Analytics, University of Cincinnati, 2925 Campus Green Dr., Cincinnati, Oh, 45221, United States of America, wuca@mail.uc.edu, Hui Guo, Yan Yu

We investigate whether the conditional CAPM helps explain the value premium using varying-coefficient single-index model. Such modeling allows for nonlinear dependence of conditional beta on state variables and significant variables are selected exhaustively. We find conditional beta co-moves with unemployment and inflation, and the price-earnings ratio. The alpha is smaller for the conditional CAPM than for the unconditional CAPM; nevertheless, neither model fully explains the value premium.

4 - Enterprise Risk Management and Capital Budgeting under Dependent Risks: An Integrated Framework

Jing Ai, Assistant Professor, University of Hawaii, 2404 Maile Way C305, Honolulu, HI, 96822, United States of America, jinga@hawaii.edu, Tianyang Wang

Risk management and capital budgeting are two critical components of corporate decision making. They need to be considered jointly at the enterprise level because of their interactions through dependent risk exposures and other synergetic relationships. This paper develops an integrated framework for optimally coordinating the two functions toward the streamlined strategic goal of the enterprise in a multi-period setting. A hypothetical example is given for a financial services company.

■ TB69

69- Suite 314- Hyatt

Energy Risk

Cluster: Optimization in Finance

Invited Session

Chair: Denis Mazieres, Head of Methodology & Modelling, LCH.Clearnet & Birkbeck, University of London, Aldgate House, 33 Aldgate High Street, London, EC3N 1EA, United Kingdom, d.mazieres@ems.bbk.ac.uk

1 - Modelling and Forecasting Electricity Price Risk with Quantile Regression

Sjur Westgaard, Associate Professor, Norwegian University of Science and Technology, 7491 Trondheim, Norway, sjur.westgaard@iot.ntnu.no, Derek Bunn, Arne Andresen, Dipeng Chen

We investigate the capability of quantile regression (QR) methods to model and forecast the tails of the spot price in the UK electricity market. QR allows us to explore how the underlying price drivers affect the different quantiles of the distribution. We demonstrate how lagged prices, prices of gas, coal and carbon, forecasts of demand and reserve margin in addition to price volatility influence the spot price distribution.

2 - Optimization of Real Options: Structural Estimation of Switching Costs in Peak Power Plants

Stein-Erik Fleten, Professor, Norwegian University of Science and Technology, Industrial Economics and Technology Mgm, Alfred Getz v 3, Trondheim, NO-7491, Norway, stein-erik.fleten@iot.ntnu.no, Knut-Harald Bakke, Jon Ragnar Viggen, Erik Haugom, Carl Ullrich

We analyze the real options to shutdown, startup and abandon gas fired power plants. The plants' status for a given year is reported to the US Energy Information Administration as either operating, in standby or retired. We use a stochastic two-factor model for the spark spread process, and estimate the irreversible costs of switching by structural estimation. The proposed nonlinear optimization analysis also indicates the spark spread triggers and option values for the switching decisions.

3 - Role of Price Spreads and Reoptimization in the Real Option Management of Commodity Storage Assets

Nicola Secomandi, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, ns7@andrew.cmu.edu

This paper shows that the real option management of commodity storage assets is easy when the asset is fast and frictionless. In contrast, analysis of the general case justifies the use of reoptimization based heuristics for computing near optimal policies and lower bound estimates on the storage value. Further, the fast and frictionless asset optimal value function yields closed form penalties based on price spreads that simplify the estimation of near tight dual upper bounds.

4 - A Kernel Based Approach to Storage and Swing Contracts Valuations in High Dimensions

Denis Mazieres, Head of Methodology & Modelling, LCH. Clearnet & Birkbeck, University of London, Aldgate House, 33 Aldgate High Street, London, EC3N 1EA, United Kingdom, d.mazieres@ems.bbk.ac.uk

This work expands upon the original work from Hubbert & Mazieres, " Tensor of Radial Basis Functions:...", where the Tensor of Radial Basis Functions (TBF) was first introduced and from Boogert & Mazieres," A Radial Basis Function Approach to Gas Storage Valuation", 2011, where it was later applied in gas storage valuation in two dimensions. This work introduces multi-factor price and volume dimensions to storage and swing contract valuation by using Kernels: RBF and TBF.

■ TB70

70- Suite 316- Hyatt

Social TV and Video

Sponsor: Information Systems

Sponsored Session

Chair: Shawndra Hill, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19103, United States of America, shawndra@wharton.upenn.edu

1 - The Quest for Content: How User-generated Links Can Facilitate Online Exploration

Gal Oestreicher-Singer, Tel Aviv University, Ramat Aviv, Tel Aviv, Israel, galos@post.tau.ac.il, Shachar Reichman, Jacob Goldenberg

Online content are presented as product networks, where nodes are content pages linked by hyperlinks. Recently, websites have begun to offer social networks as well, creating a dual-network structure. We use data from YouTube and investigate the role of this dual-network structure in facilitating content exploration.We also present seven internet studies in which participants, browsing a YouTube-based website, are exposed to different conditions of recommendations.

2 - What's the Buzz About: Analyzing Social Media Response to TV Ads

Shawndra Hill, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19103, United States of America, shawndra@wharton.upenn.edu

We study the relationship between Ad attributes and online Buzz. We link the attributes to buzz levels, sentiment and specific content.

3 - Social TV: Linking TV to Social Media and Sales

Adrian Benton, University of Pennsylvania, Philadelphia, PA, United States of America, adrian.donald.benton@gmail.com, Shawndra Hill

"Social TV" is a term that broadly describes the online social interactions that occur between viewers while watching television. In order to better understand the relationship between television content, buzz on online social media, and ultimately viewership and sales, we examine the American television program, The Voice. In this talk, we present analyses linking television content presented to buzz on Twitter and sales on iTunes.

■ TB71

71- Suite 318- Hyatt

Energy Information Systems

Sponsor: eBusiness

Sponsored Session

Chair: Wolf Ketter, Associate Professor of Information Systems, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, wketter@rsm.nl

1 - Designing Balancing Mechanisms for Energy Markets using Realistic Customer Models

Konstantina Valogianni, PhD Candidate, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, kvalogianni@rsm.nl, Wolf Ketter, Mathijs de Weerdt, John Collins

We present balancing mechanisms for a decentralized and deregulated energy market using controllable customer capacities. We model customers' controllable capacities based on real-world data, since a crucial part for designing precise balancing mechanisms is a realistic customer representation.

2 - Autonomous Agent-based Decision-making for the Smart Electricity Grid

Markus Peters, PhD Candidate, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, m@rkuspeters.de, Wolf Ketter, Maytal Saar-Tsechansky, John Collins

The vision of a Smart Electricity Grid requires substantial advances in intelligent decentralized control mechanisms. We study a novel class of autonomous brokers that derive profit-maximizing strategies from interaction with their environment and demonstrate their performance in experiments with real-world data. Our work lays the foundation for innovative intermediation services that enable customer participation in the Smart Grid, and enhance the economic sustainability of power systems.

3 - Energy Informatics in Transportation Systems: Combining Telematics Data with O.R.

Sudip Bhattacharjee, Associate Professor, University of Connecticut, Storrs, CT, United States of America, sbhattacharjee@business.uconn.edu, Alex Tung

Empty trailer trips (backhaul) lead to revenue loss, pollution, fuel consumption, and cost over a billion dollars each year. We use telematics data to match routes for "backhaul brokering". Data analytics is used to create maps of trailer movement and frequent patterns. Subsequently, optimization provides tools to choose revenue enhancing and energy saving routes. This contributes to the emerging area of energy informatics where energy optimization and revenue are key to business sustainability.

4 - Auction Design for Local Reserve Energy Markets

Reinhard Madlener, Professor of Energy Economics and Management, RWTH Aachen University, Mathieustrasse, Aachen, 52074, Germany, RMadlener@eonerc.rwth-aachen.de, Christiane Rosen

We develop an auction mechanism that is designed for a local energy market. It is aimed at enabling regional trading of ancillary services, but can also be used for administering negotiation processes in virtual power plants or microgrids. In order to test the performance of the proposed auction mechanism, a simple multiagent-based simulation program has been devised. We find that the theoretical predictions hold in fact and competition quickly leads to price convergence.

■ TB72

72- Suite 322- Hyatt

Computational Stochastic Optimization in Energy II

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Ricardo Collado, Post-Doctoral Associate, Princeton University, Department of Operations Res. & Financial Eng, Sherrerd Hall, Charlton Street, Princeton, NJ, 08544, United States of America, rcollado@princeton.edu

1 - Approximate Dynamic Programming for an Energy Storage Problem

Warren Scott, PhD, Princeton University, ORFE Departement, Princeton, NJ, 08544, United States of America, wscott@princeton.edu, Warren Powell

We use approximate dynamic programming to solve an energy storage problem which combines wind turbines, an electricity storage device, and the electrical grid in order to satisfy a load. For approximate policy iteration we compare least-squares Bellman error minimization, Bellman error minimization with instrumental variables, and projected Bellman error minimization. For direct policy search, we apply the approximate knowledge gradient framework to efficiently optimize the storage policy.

2 - Adaptive Convex Enveloping for Multidimensional Stochastic Dynamic Programming

Sheng Yu, George Washington University, 1776 G Street NW, Suite 101, Washington, DC, 20052, United States of America, yusir@gwmail.gwu.edu, Enrique Campos-Nanez

Adaptive Convex Enveloping (ACE) is a powerful general purpose method for solving convex stochastic dynamic programs. With its optimization-oriented design, ACE easily handles large numbers of decision variables and constraints with the speed and reliability of convex optimization, and approximates the value function with error controlled everywhere. As a demonstration, we use ACE on electric vehicle battery station management and find the optimal policy for charging massive number of batteries.

3 - Dynamic Optimization of Threshold Risk Measures & Applications to Energy Markets

Ricardo Collado, Post-Doctoral Associate, Princeton University, Department of Operations Res. & Financial Eng, Sherrerd Hall, Charlton Street, Princeton, NJ, 08544, United States of America, rcollado@princeton.edu, Warren Powell

We introduce a new family of risk measures suitable for applications where the natural risk-averse model requires not to fall below a threshold. We call these "threshold risk measures" and it arise naturally in problems related to energy markets and hedging. Our presentation discuss the threshold risk measures in the context of dynamic programming and an application in the trading of energy futures and spot contracts.

■ TB73

73- Suite 324- Hyatt

Lot Sizing and Production Planning

Contributed Session

Chair: Ilke Bakir, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30332-0205, United States of America, ibakir3@gatech.edu

1 - Primary Pharmaceutical Manufacturing Scheduling Problem

Subhash C. Sarin, Professor, Virginia Tech, Virginia Polytechnic and State Univ., 250 Durham Hall, Blacksburg, VA, 24061, United States of America, sarins@vt.edu, Hanif D. Sherali, Lingrui Liao

We address an integrated lot-sizing and scheduling problem in a pharmaceutical supply chain. Products from multiple levels are scheduled on parallel and capacitated bays for production in batches. Sequence-dependent setup times and costs are required between batches of different product families, inducing a traveling salesman type of substructure. We present a column generation-based method in concert with valid inequalities to address this problem.

2 - The Capacitated Lot Sizing Problem with Piecewise Concave Production Costs

Esra Koca, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, ekoca@bilkent.edu.tr, M. Selim Akturk, Hande Yaman

In this paper, we consider the capacitated lot sizing problem with piecewise concave costs and concave inventory holding costs. We develop a dynamic programming (DP) algorithm that solves this problem in polynomial time when the number of breakpoints of the cost function is fixed and the breakpoints are the same for all periods. To the best of our knowledge, this is the first algorithm that solves this problem in polynomial time. We test the DP with different MIP formulations.

3 - Production Planning and Scheduling with Sequence-dependent Changeover Cost

Qingwei Li, Eastman Chemical, 200 S Wilcox, Kingsport, TN, United States of America, billdoors0755@gmail.com, Dayana Cope

To minimize the total change-over cost in production, we developed a multi-line multi-product discrete lot-sizing model with sequence-dependent change-over cost.

4 - Production Planning Problem for Suppliers with Uncertain Advance Demand Information

Nobuyuki Ueno, Professor, Prefectural University of Hiroshima, 1-1-71,Minami-ku,Hiroshima, Hiroshima, 734-8558, Japan, ueno@pu-hiroshima.ac.jp, Koji Okuhara, Takashi Hasuike

We model a supplier's production planning problem with uncertain advance demand information called 'Naiji' in automobile industries. It is formulated as a stochastic programming problem which minimizes the cost subject to a probabilistic inequality under the condition that the inventory in 2 periods is correlated. We propose a new procedure to obtain an optimal solution on the 'lattice' without requiring the repeated evaluation of gradients of a probabilistic function containing integrals.

5 - Column Generation for Production Planning with Alternative Routings

Ilke Bakir, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30332-0205, United States of America, ibakir3@gatech.edu, Reha Uzsoy

We propose a column generation approach for production planning problems with a very large number of alternative routings. Computational experiments show that the proposed approach finds optimal solutions that use a very small number of the possible routings compared to the classical path-based approach.

Tuesday, 12:30pm - 2:30pm

■ Interactive Session

West Ballroom Foyer, Level 300

Interactive Session

Cluster: Interactive Poster Session

Invited Session

Chair: Young-Jun Son, The University of Arizona, Systems and Industrial Engineering, Phoenix, AZ, United States of America, son@sie.arizona.edu

Co-Chair: Burcu Keskin, University of Alabama, Huntsville, AL, United States of America, bkeskin@cba.ua.edu

Co-Chair: Jian Liu, University of Arizona, Tempe, AZ, United States of America, jianliu@sie.arizona.edu

1 - Establishing the Optimal Drain Tile Network Based on Field Characteristics

Luke Holt, P.h.D. Student, North Dakota State University, 1201 Albrecht Boulevard, Fargo, 58102, United States of America, Luke.Holt@my.ndsu.edu, Nimish Dharmadhikari

Midwestern agricultural producers have recently been subject to high precipitation growing conditions. During this time, commodity prices have been great, and input costs have risen. These trends have sparked the installation of field drain tile at record rates. OR analysis is done to establish the best tile network.

2 - A Combined-Model Solution Approach for the HVRPTW

Ilknur Uludag, PhD Student, Department of Industrial and Systems Engineering, Auburn University, Auburn, AL, 36849, United States of America, izt0002@auburn.edu

Two new mathematical formulations for the Heterogeneous Vehicle Routing Problem with Time Windows (HVRPTW) are proposed. One model features a combination of binary and continuous decision variables, while the other model relies on only binary decision variables with discretized time. While neither model is superior individually, a novel solution approach utilizing a combination of both models appears to be promising. Empirical results demonstrate the effectiveness of the proposed approach.

3 - No-Arbitrage Implied and Local Volatility Surfaces for Option Pricing and Hedging

Jaewook Lee, Seoul National University, 599 Gwanak-ro, Gwanak-gu, Seoul, Korea, Republic of, jaewook@snu.ac.kr

We propose a novel smoothing method to implement no-arbitrage constraints in estimating the implied and local volatility surfaces extracted from option prices using multiple local bandwidths. Through simulation on KOSPI200 index options, we find that implied and local volatility modeling under arbitrage-free conditions show better performance in terms of estimation, pricing, and hedging near the out-of-the-money and in the money options with short maturities.

4 - A Genetic Algorithm for Vehicle Routing Problem with Simultaneous Pickup and Delivery

Fulya Altiparmak, Gazi University, Dept.of Industrial Engineering, Ankara, Turkey, fulyaal@gazi.edu.tr, Ismail Karaoglan, Fatma Pinar Goksal

This study considers vehicle routing problem with simultaneous pickup and delivery (VRPSPD). Since the VRPSPD is an NP-hard problem, a hybrid solution approach based on genetic algorithm and variable neighborhood descent algorithm is proposed. The effectiveness of the proposed algorithm is investigated by an experiment on benchmark problem instances available in the literature. The computational results show that the proposed algorithm competes with the heuristic approaches in the literature.

5 - Decision and Risk Analysis Based Interactive Project Evaluation Approach on Oil Project

Omer Faruk Baykoc, Gazi University, Maltepe, Ankara, Turkey, baykoc@gazi.edu.tr, Mustafa Duygu

This study presents an integrated modeling approach for oil exploration and production projects. While constructing the model which reflects the real system best, all input and output factors have been included in the model with their specific distributions. Model outcomes derived as a result of study, which are used for project decisions, were tried to be included whole of uncertainties caused by each factor along the model.

6 - Supplier Selection and an Application in the Baby Food Sector

Bahri Berker Ugur, Student/Gazi University, Asikveysel Mah. 322.Sokak 8/18 Mamak, Ankara, Turkey, bahriberker@gmail.com, Birsen Çevik, Mesut Kozan, Mürsel Dalyanoglu, Bahar Özyörük

In this study,for a baby food manufacturer, supplier selection problem is discussed and Axiomatic Design (AD) method is proposed for the solution of the problem. Since, all of the factors that affect supplier selection process can not be denoted by numerical values, the evaluation of the firms has been done by using triangular fuzzy numbers and fuzzy AD has been used for the evalution.

7 - Improving Production and Design Processes through Advances in Experimental Design Analysis

Jonathan Linton, Professor, University of Ottawa, DMS 6108 Laurier Street East, Ottawa, ON, K1N 6N5, Canada, drjdlinton@gmail.com, Chris Gatti, Quanhong Jiang, Mark Embrechts

Manufacturers rely on Taguchi Design of Experiments for improving processes. A study of 107 experiments assesses the use of PLS offering insights on: experimental quality, results and additional information that is obtainable. Data sets fell into four categories: appropriate sample, more data advisable, biased model and inappropriate model. In summary, PLS offers additional information that enhances the use of Taguchi DOE and guides further experimentation.

8 - Parallel Machine Scheduling Problem: An Application

Gul Didem Batur, Gazi University, Industrial Eng. Dept., Ankara, Turkey, dbatur@gazi.edu.tr, Serpil Erol

We have considered the parallel machine scheduling problem arising in the cable production department of a bus factory. In order to obtain the best part/machine assignments and balance the workloads, we have constructed a mathematical model and proposed a heuristic algorithm. Solutions of both methods are compared with respect to the problem objectives and the methods' effectiveness.

9 - When Prospects Don't Matter: Decision-Making under Resource Constraints & Impact on Performance

Niharika Garud, PhD Candidate, IIM Bangalore, C/O FPM Office, IIM Bangalore, Bannerghatta Road, Bangalore, KN, 560076, India, niharikag08@iimb.ernet.in

This paper presents an alternate view of decision-making in inherently uncertain and resource constrained conditions where individuals minimize their losses irrespective of prospects of outcomes. These choice patterns are inconsistent with both expected utility theory & prospect theory. We found that individuals developing hi-tech products *focus on loss minimization in terms of their assets and resources and *are consistently "risk averse" irrespective of variation in prospects of outcomes.

10 - Planning a Cross-trained Workforce in Retail Sector

Cèsar Augusto Henao Botero, Pontifcia Universidad Catòlica de Chile, Vicuña Mackenna 4860, Macul, Santiago de Chile, Chile, cahenao@uc.cl, Juan Carlos Muñoz Abogabir

Retail workforce inflexibility is one of the sources for under and overstaffing. We propose to use cross-trained staff that may be assigned to different store's departments. Our model determines how many employees are required by department, how many will be cross-trained, what skills should they have, and their time dependent assignment. Some policy conclusions are derived from data obtained from a large retail firm in South America.

11 - Pharmaceutical Supply Network Design: Risk-Averse or Risk-Neutral?

Alireza Madadi, Clemson University, 110 Freeman Hall, Department of IE, Clemson, SC, 29631, United States of America, amadadi@clemson.edu, Julia Sharp, Kevin Taaffe, Scott Mason, Mary E. Kurz

We investigate a supply network design with unreliable supply. We consider two types of decision making policies a risk-neutral decision-making policy and a risk-averse policy wherein, the decision-maker uses a CVaR approach to measure risk and to define worst-case scenarios. After introducing the underlying optimization models, we present computational analysis and statistical analysis to compare the results of the risk-averse and risk-neutral policies and provide several managerial insights.

12 - How Does Network Structure Influence Traceability?

Abigail Horn, PhD Student, Engineering Systems Division, MIT, 77 Massachusetts Avenue, Building E40-261, Cambridge, MA, 02139-4307, United States of America, abbyhorn@mit.edu, Xin Lu

We study the problem of finding the source of spreading through a network by modeling a contaminant in the food distribution network. We construct an estimator for the outbreak source and show how its ability to narrow down the source identification problem changes with the network's structure. We propose a measure for traceability, or the overall ability to identify the source of spreading given any set of outbreak observations, based on entropy.

13 - Scheduling Close Combat Air Support using Simulation
David Cornejo, North Carolina State University, 1207 Goldenview Ct, Durham, NC, 27713, United States of America, dacornej@ncsu.edu

Close Combat Air Support, support of ground missions using aircraft, is essential to modern military operations. Demand for such support is stochastic and thus difficult to plan appropriately. We present a simulation model that allows analysis of the effects of various schedules on aircraft utilization and service levels.

14 - An Integrated Discrete-Event/System Dynamics Simulation of Breast Cancer Screening for US Women
Jeremy Tejada, Postdoctoral Student, University of Texas, 210 Calibre Chase Drive, Apartment 303, Raleigh, NC, 27609, United States of America, jjtejada@ncsu.edu

The objective of this research is to develop, validate, and exploit a simulation modeling framework for evaluating the effectiveness of breast cancer screening policies in the near future (that is, over the period 2012–2020) for US women who are at least 65 years old. This work includes an examination of key components in the breast cancer screening process for older women, and an approach to defining and modeling those components using simulation.

15 - Assembling Balanced Incomplete Block Design Tests with Mixed Integer Linear Programming
Pei-Hua Chen, National Chiao Tung University, 1001 Ta Hsieh Rd., HsinChu, 300, Taiwan-ROC, peihuamail@gmail.com, Daniel Junglas

The nationwide educational assessment in Taiwan is based on the structure of a balanced incomplete block design with more than one content area per block. This study uses Mixed Integer Linear Programming to assemble sets of parallel booklets following a balanced incomplete block design.

16 - Method of Successive Modifications of Functional for Transportation Problem with Warehousing
Vladimir Tsurkov, Prof., Computing Centre of Russian Academy of Sciences, Vavilov str., 40, Moscow, 119333, Russia, tsur@ccas.ru, Dmitry Kuzovlev, Alexander Tizik

Classical transportation problem is considered with additional warehouse points for suppliers and consumers. Main functional is augmented with expenses for transportation to these warehouses. Appropriate variables specifying amounts of goods delivered to warehouse points are introduced. Method of successive modifications of functional is employed for solving since standard method yields laborious procedures. Sample is presented, which illustrates efficiency of the algorithm.

17 - Antiviral Resistance and Mitigation of Pandemic Influenza
Sandro Paz, PhD Candidate/Associate Professor, University of South Florida/Pontificia Universidad Catolica del Peru, 18125 Birdwater Dr., Tampa, FL, 33647, United States of America, spaz@mail.usf.edu, Alex Savachkin

We are building a large-scale simulation optimization framework for antiviral based mitigation of pandemic influenza. The model considers an oseltamivir-sensitive strain and a resistant strain with low/high fitness cost. Mitigation strategies include treatment of symptomatic cases and chemoprophylaxis of pre- and post-exposure cases.

18 - The Volunteer's Dilemma in Readmissions and Other Game Theory Problems in Healthcare
Brendan Bettinger, Graduate Research Assistant, Northeastern University, 360 Huntington Ave., Boston, MA, 02115, United States of America, bettinger.b@husky.neu.edu

Healthcare coalitions and coordination across organizations are subject to the volunteer's dilemma. Each participant benefits when maximum care is provided, but also would prefer others assume more of the responsibility. We develop probabilistic models to describe these dynamics and explore conditions affecting the failure to provide care provision. We also explore other applications of game theory in a healthcare setting, including the tragedy of the commons and fair division.

19 - Reliability Analysis of Systems Subject to Degradation and Shocks
Sara Ghorbani, PhD Student, Rutgers, Rutgers 23629 BP.O. WaY, Piscataway, NJ, 08854, United States of America, ghorbani@rci.rutgers.edu, Elsayed A. Elsayed, Hoang Pham

Abstract System's failure can be described by underlying degradation and random shocks. In this paper, we consider systems subject to both degradation and shocks and that the impact of their impact is dependent on the magnitude of shocks as well as the "health state" of the system. We develop expression for the total damage at any time and calculate the system reliability for a given threshold.

20 - A Simulation Optimization Approach to Epidemic Forecasting
Elaine Nsoesie, Virginia Tech, 1880 Pratt Drive, RBXV, Blacksburg, VA, 24060, United States of America, onelaine@vbi.vt.edu, Sara Shashaani, Richard Beckman, Kalyani Nagaraj, Madhav Marathe

We introduce a simulation optimization (SIMOP) approach for real-time forecasting of the epidemic curve. The forecasting SIMOP procedure combines an individual-based model and the Nelder-Mead simplex optimization method. Epidemics simulated over synthetic social networks representing Montgomery County in Virginia, Miami, and Seattle, as well as the H1N1 pandemic in Los Angeles estimated from incidence data in September 2009, are forecasted using this method.

21 - Detecting Changes in the Mean from Censored Lifetime Data using Profile Monitoring techniques
Ehsan Jafari-Shirazi, West Virginia University, 2900 University Ave. Apt 4, Morgantown, WV, 26505, United States of America, ejafaris@mix.wvu.edu

Monitoring censored lifetime data in which life has a univariate distribution has been investigated in the literature. Sometimes, life is dependent on some explanatory variables where it can be characterized as a function. In such situations, it is desired to monitor the function or the profile used for modeling the relationship between the explanatory variables and the response (life). In this study, two methods for monitoring censored lifetime profiles are proposed.

22 - Real-Time Integrated Airport Surface Movement Controlling
Qing Wang, University of South Florida, 14215 Les Palms Circle, Apt. 201, Tampa, FL, 33613, United States of America, qingwang@mail.usf.edu, Yu Zhang

In this study, we propose a real-time integrated airport surface movement controlling model. Given a set of arrival and departure flights in a specified planning horizon, the model determines 4D trajectories of aircraft that minimize total taxi time and maximize runway throughput subject to the operational constraints and safety requirements.

23 - Properties of a General Family of Agreement Metrics
Stephen France, Assistant Professor, University of Wisconsin-Milwaukee, P. O. Box 742, Milwaukee, WI, 53207, United States of America, france@uwm.edu

We describe a family of metrics for measuring agreement between sets of solution configurations. We describe extensions for measuring confidence intervals and investigating statistical hypotheses. We describe a set of software tools developed in MATLAB and R. We show how the agreement metrics can be used to evaluate dimensionality reduction methods, tune method parameters, and evaluate how solution configurations change over time.

24 - Multi-period Defensive Resource Considering Equity and Possibly Non-strategic Attackers
Xiaojun Shan, PhD Candidate, University at Buffalo, The State University of New York, 435 Bell Hall, Buffalo, NY, 14260, United States of America, xshan@buffalo.edu, Jun Zhuang

We study defensive allocation in a multi-period multi-target defender –attacker game. We also study cost of equity (fairness) in defensive resource allocation. We develop a novel model in which a government allocates defensive resources among multiple targets, while reserving a portion of defensive resources (represented by the equity coefficient) for equal distribution. Moreover, we study the robustness of defensive resource allocations against a possibly non-strategic attacker.

25 - Detecting the Undetectable: When the Distinction between 2+2=4 and 2*2=4 Means Everything
Raisa slepoy, Statistician, Private, 6006 Madawaska Road, Bethesda, MD, 20816, United States of America, rslepoy@gmail.com

Hand recorded data captured in the field of operations have increasingly become important for agencies relying on fast turnaround requests for information to make fund allocations to insure resources meet the mission objectives.These decisions drive the success or failure of the outcome. We propose a method of correcting quantity data by extending Luhns algorithm to validate identification numbers, such as credit card and ISBN numbers.Using this method we identified a common type of error.

26 - Bayesian Optimal Learning for Budget Allocation in Crowdsourcing
Qihang Lin, PhD Students, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qihangl@andrew.cmu.edu, Xi Chen, Dengyong Zhou

We study the budget allocation in crowd labeling for classification where each instance can be labeled multiple times. Given a fixed amount of budget, a challenging problem is how to allocate the budget across instances with different intrinsic ambiguity so that the classification accuracy is maximized. We adopt the Bayesian optimal learning framework and formulate the problem into a finite-horizon MDP. We further propose several approximate DP methods to efficiently solve the MDP.

27 - Analysis of Buyback Operations for Commercial Vehicles

Zeynep Kirkizoglu, Sales Support Manager, MAN Truck & Bus Turkey, Esenboga Havalimani Yolu 22.Km, Akyurt, Ankara, 06750, Turkey, zkirkizoglu@gmail.com

We analyze the potential buyback operations for the Turkish sales office of a commercial vehicle manufacturer. Buyback operations are currently not fully implemented, but are expected to be one of the major business lines in the future. We especially analyze the combined pricing of buybacks, including extended warranty and maintenance contracts; and the related benefits and costs. This is in line with the overall approach of "providing transport solutions," rather than simply selling vehicles.

28 - Facilitating Interoperability between Community Networks using Semantic Technologies

Vijayan Sugumaran, Professor, Sogang University, Department of Global Service Management, Seoul, Korea, Republic of, sugumara@oakland.edu

This research focuses on developing a service-oriented architecture consisting of middleware services to allow community-based data and knowledge creation, organization, sharing and inter-operation. We have developed a methodology and a set of tools that utilize loosely coupled web services that promote interoperability within and across communities connected through an interoperability network. The contribution is the delineation of the processes (work flows) and the needed infrastructure.

29 - Semidefinite Approximations for Economic Order Quantity Problems

Carolina Saldana Cortes, Professor, Universidad Externado de Colombia, Calle 12 N 1-17 Este, BOGOTA, Colombia, jenny.saldana@uexternado.edu.co

This work is a research contribution in the direction to finding new ways to solve (S,s) type basic problems, as is the Economic Order Quantity (EOQ) one in an effective way. To that end alternative methods of semidefinite relaxation of dynamical programs using binary variables are proposed. In order to offer a quantitative approach as an illustrative case, the models developed are applied to data coming from a representative firm of the Colombian ceramics sector.

30 - Investigation of Hiring & Wage Decisions in the Workforce Supply Problem

Oanh (Olivia) Hoang, University of Alabama, ohoang@crimson.ua.edu, John Mittenthal, Nathan Palmer, Charles Sox

Minimizing labor cost while attracting enough workers is critical for a multi-facility enterprise. The decisions are how many workers to hire, and how much to pay each one. This study investigates coordinated versus uncoordinated workforce supply decisions. The results indicate that coordinated decisions yield lower total labor costs.

31 - Improving School Choice: Keeping Communities Together Via Correlated Lottery

Peng Shi, MIT Operations Research Center, 77 Massachusetts Ave., E40-149, Cambridge, MA, United States of America, pengshi@mit.edu

In school choice, children submit a ranked list of schools they prefer, and schools submit priorities over children; a centralized algorithm makes the assignment. Current school choice algorithms tend to disperse communities so kids do not go to school with others from their neighborhood. We improve community cohesion in school choice mechanism by implementing a correlated lottery, which is NP-hard in general but we have a heuristic that does well in practice.

32 - Scatter Search for the Single Row Facility Layout

Ravi Kothari, Indian Institute of Management Ahmedabad, c/o SAO Office, Dorm-21, Room-16,, Ahmedabad, 380015, India, ravikothari@iimahd.ernet.in, Diptesh Ghosh

The single row facility layout problem is the problem of arranging facilities with given lengths on a line, with the objective of minimizing the weighted sum of the distances between all pairs of facilities. The problem is NP-hard and research has focused on heuristics to solve the problem. We present four scatter search algorithms to solve large sized instances. Our computational experiments show that the algorithms generate better solutions to 15 of the 58 benchmark instances.

33 - Planning Pilot Training in Turkish Naval Force

Bülent «atay, Sabanci University, Fac. of Engineering & Natural Science, Istanbul, 34956, Turkey, catay@sabanciuniv.edu, Tevfik Altinalev

We address the pilot training planning problem at Turkish Naval Air Force. Our aim is to determine weekly flight training plans such that the number of combat-ready pilots is maximized at the end of the planning horizon. We formulate a 0-1 mixed-integer linear program and discuss heuristic methods based on LP relaxation, Lagrangean relaxation, and Lagrangean decomposition. Our experimental results show that the Lagrangean decomposition with subgradient optimization provides good bounds.

34 - using Simulation to Improve Yarn Manufacturing Throughput

Wei Zhao, Clemson University, 854 Issaqueena Trail, Apt. #202, Hunter's Glen, Central, SC, 29630, wz@clemson.edu, Scott Mason, Kevin Taaffe

Glen Raven Custom Fabrics identified the need to improve their yarn manufacturing throughput. While theoretical capacity of subprocesses could be calculated, determining the practical operating capacity was challenging, given the multiple subprocesses as well as the size and mix of orders. Using simulation to experiment with staffing assignments, machine and process configurations, the company estimates their cost savings, after implementing the process changes, to be US $2.4 million per year.

35 - Railway Freight Distribution Network Design and New Applications in Turkey

Bahar Özyörük, Ass. Prof. Dr., Gazi University, Gazi University Faculty Engineering, Dep. of Industrial Eng., Ankara, 06570, Turkey, bahar@gazi.edu.tr

Railways to carry too much load is very important for the country's economy. In this study, the current railways transportation in Turkey are evaluated. Location of to increase the share of freight transport.Emphasized the importance of the establishment of villages. Assessed alternative areas of logistics village.A model was established and model is solved by using LINDO Software Solver and the results are interpreted.

36 - Minimizing Emissions in Facility Location

Fan Jia, University of Minnesota, 111 Church Street S.E., Minneapolis, MN, 55455, United States of America, jiaxx049@umn.edu, John Gunnar Carlsson

We consider a continuous facility location problem in which our objective is to minimize the total emissions. We first analyze the limiting behavior of this model and give an asymptotically optimal configuration - Archimedean spiral. We show that the total emissions can be reduced by over 27% this way compared to the popular honeycomb configuration. Finally, we give a fast constant-factor approximation algorithm for finding the emissions-optimal placement of facilities in any convex polygon.

37 - Structure of Demand and Consistent Conjectural Variations Equilibrium in a Mixed Oligopoly Model

Vyacheslav Kalashnikov, Assistant Professor, ITESM, Campus Monterrey, Ave. Eugenio Garza Sada 2501 Sur, Monterrey, NL, 64849, Mexico, kalash@itesm.mx, Vladimir Bulavsky, Mario A. Ovando Montantes, Nataliya Kalashnykova

A model of mixed oligopoly with conjectured variations equilibrium with a non-continuous demand function is studied. The agents' conjectures concern the price variations depending upon changes in their production output. Existence and uniqueness results for the conjectured variations equilibrium for any set of feasible conjectures are established. A notion of the interior equilibrium (based on a consistency rule) is introduced, and the existence theorem for the interior equilibrium is proved.

38 - Modeling the Evolution of Dependency between Demands, with Application to Inventory Planning

Amirhosein Norouzi, PhD Student, NC State University, 6900 Crescent Moon Ct., Apt 306, Raleigh, NC, 27606, United States of America, anorouz@ncsu.edu, Reha Uzsoy

We show that the progressive realization of uncertain demands through successive forecast updates results in the evolution of the conditional demand-covariance in addition to the conditional demand-mean. A dynamic inventory model with forecast updates is used to illustrate an application of our method. We show that how the optimal inventory policy depends on conditional covariances.

39 - U. S. Department of Homeland Security's Simulations of Pedestrian Movement for Site Security

Doug Samuelson, President/Chief Scientist, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, infologix1@aol.com

The U. S. Secret Service (USSS) has substantial modeling and simulation capabilities for event planning and personnel training. Recent projects are a stadium / arena Evacuation Planning Tool (EPT) and a Site Security Planning Tool (SSPT), a smaller-scale, video game based simulator for planning and training. Next steps include more realistic crowd behaviors, responses to toxic plumes or secondary attacks, and pursuing a single integrated all-purpose, all-scales model and interface.

40 - Integrating Supply Chain Network Model for Auto Industry in Midwest using GIS

Yasaman Kazemi, North Dakota State University, P.O. Box 6050, NDSU UGPTI Dept. 2880, Fargo, ND, 58108, United States of America, yasaman.kazemi@ndsu.edu, Eunsu Lee

This study develops a model for domestic automobile supply chain in the Midwest area based on minimum cost (distance) and integrates it into highway transportation network via GIS spatial interaction to predict the minimum flow from origins to destinations by choosing an optimal sequence of routes in order to optimize the total cost of supply chain network.

41 - Experiences with Data Mining in Support of Radiation Portal Monitoring at Border Crossings
Tom Burr, Los Alamos National Lab, Mail Stop F600, Los Alamos, NM, 87545, United States of America, tburr@lanl.gov, Michael Hamada

Radiation Portal Monitors screen vehicles to protect against illicit special nuclear material (SNM) such as Uranium, which emit neutrons and/or gammas. One complication is naturally occurring radioactive materials (NORM) which leads to nuisance alarms. This paper describes data mining applied to RPMs as related to background suppression; efficient methods to examine multiple candidate alarm options; smoothing spectral data; sensor drift, and pattern recognition to recognize common NORMs.

42 - Machine Learning and Algebraic Geometry for Network Data
Ian Dinwoodie, Assistant Professor, Portland State University, Dept. Math and Stat, Portland, OR, 97201, United States of America, ihd@pdx.edu

Understanding interactions and steady states for biological networks from data of multivariate time series requires a range of statistical and mathematical tools. Discretization, machine learning, and algebraic geometry together can be used for practical questions of node dependence and exclusion from basins of attraction.

43 - Tractable Approximations to Multi-Period Hydroelectric Power Station Management
Limeng Pan, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S Mathews Ave., Urbana, IL, 61801, United States of America, pan24@illinois.edu

We study a complex Hydroelectric Power Station operation problem. A series of tractable approximations using Linear Decision Rules in the perspective of robust optimization are developed to achieve both the tractability and reliability. In the numerical study, the world's largest multi-purpose reservoir, the Three Gorges Reservoir (TGR), is used to test the performance of our models. The optimal values from our tractable approximations are matching the benchmark optimal value from SDP.

44 - A Recycling Network Design for Multiple Products and Multiple Material Types
Ertan Güner, Prof.Dr., Gazi University, Industrial Engineering Department, 06570- Maltepe, ANKARA, Turkey, erguner@gazi.edu.tr, Kemal Kalaykiran

Recycling is one of the most common recovery methods both in the application. In this study, a recycling network is designed for multiple products and multiple material types. The components of the system taken into consideration are customer zones, potential collection facilities and recycling facilities. The problem is defined in detail and a mixed integer mathematical model is presented.

45 - Supply Chain Design Simulation
Sima Maleki, University of Tennessee, 1172 Keowee Avenue, Knoxville, TN, 37919, United States of America, smaleki@utk.edu

ARENA is used to design alternative supply chain networks and compare them with existing network to help a manufacturing company decide on their future model. Transportation cost, throughput, lead time, capacity and service level are key performance factors. Considering uncertainty in demand, a centralized production hub with local distribution hubs offers better service. Hierarchical decentralized production facilities which perform local distribution offers lower transportation cost.

46 - Multiscale Recurrence Analysis of Long-Term Nonlinear and Nonstationary Time Series
Yun Chen, Mr., University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, yunchen@mail.usf.edu, Hui Yang

Recurrence analysis is an effective tool to characterize and quantify the dynamics of complex systems. However, recurrence computation is highly expensive as the size of time series increases. Few, if any, previous approaches have been capable of quantifying the recurrence properties from a long-term time series. This paper presents a novel multiscale framework to explore recurrence dynamics in complex systems and resolve computational issues for a large-scale dataset.

47 - Transmission Expansion Planning using an Linearized AC Model
Hui Zhang, Research Associate, Arizona State University, 5th floor, Room 519, 551 E. Tyler Mall, Tempe, AZ, 85281, United States of America, dahui911@hotmail.com, Hui Zhang, Gerald Heydt, Vijay Vittal, Jaime Quintero

The motivation of this work is to develop a less relaxed network model based on which a better TEP result can be obtained. First, a novel approach to linearize the full AC network model is presented. Based on the linearized network model, a mixed-integer second order cone programing (MISOCP)-based TEP model is then proposed. The proposed TEP model includes the linearized reactive power, off-nominal voltage magnitudes and network losses.

Tuesday, 1:30pm - 3:00pm

■ TC01

01- West 101- CC

Global Optimization in Graphs/Networks

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Sergiy Butenko, Associate Professor, Texas A&M University,Industrial & Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States of America, butenko@tamu.edu

1 - A Branch-and-bound Approach for Maximum Quasi-cliques
Zhuqi Miao, PhD Student, Oklahoma State University, 808 N. Monroe, Apt. 32, Stillwater, OK, United States of America, Zhuqi.Miao@okstate.edu, Foad Mahdavi Pajouh, Baski Balasundaram

Detecting quasi-cliques is an important tool for detecting dense clusters in graphs. Quasi-clique detection has been accomplished using heuristic approaches in various applications of graph-based data mining. However, exact approaches for the problem are limited to two mixed integer programming formulations that were proposed recently. This article presents a new combinatorial branch-and-bound algorithm for the maximum quasi-clique problem and studies its performance on benchmark instances.

2 - On a Class of Bilevel Linear Assignment Problems
Vladimir Stozhkov, University of Florida, 303 Weil Hall, Gainesville, FL, 32611-6595, United States of America, vstozhkov@ufl.edu, Vladimir Boginski, Eduardo Pasiliao, Oleg Prokopyev

We consider a bilevel extension of the linear assignment problem. The follower solves an assignment problem maximizing his profit, while the leader may interdict removing some of the nodes of the graph. The leader's task is to minimize the total cost given by the cost of interdiction plus the cost of the assignments made by the follower. The problem is shown to be NP-hard. We also derive equivalent linear mixed 0-1 programming reformulations and discuss possible heuristic solution approaches.

3 - Minimum Selective Dominating Set Problem
Je Sang Sung, Research Assistant, Texas A&M University, 302 Ball Street, Apt. G204, College Station, TX, 77840, United States of America, blackism@neo.tamu.edu, Sergiy Butenko

We introduce several variations of the classical graph-theoretic concept of domination that are motivated by practical considerations. Complexity of the corresponding optimization problems is analyzed showing these variations are hard on their own respect. We also establish some basic properties of the corresponding polyhedra, and analytical bounds on the size of structures of interest.

4 - A Global Optimization Algorithm for the Maximum Biclique Problem in Large-scale Networks
Shahram Shahinpour, Texas A&M University,Industrial & Systems Engineering, TAMU-3131, College Station, TX, 77843, United States of America, shahinpour@neo.tamu.edu, Zeynep Ertem, Sergiy Butenko

We present a scale reduction technique for solving the maximum vertex biclique problem in general graphs. Analytical bounds for the solution size in random graphs will also be explored. Experimental results on large real life networks show that the proposed algorithm is very effective in solving all test cases to optimality.

■ TC02

02- West 102 A- CC

Joint Session DAS/HAS: Decision Analysis in Public Health

Sponsor: Decision Analysis & Health Applications Society

Sponsored Session

Chair: Jagpreet Chhatwal, Assistant Professor, University of Pittsburgh, 130 De Soto St, Pittsburgh, PA, United States of America, chhatwal@pitt.edu

1 - Optimal Colorectal Cancer Screening: Balancing Harms and Benefits

Fatih Safa Erenay, Assistant Professor, University of Waterloo, 200 University Ave. CPH 4323, Waterloo, ON, Canada, ferenay@uwaterloo.ca, Oguzhan Alagoz, Adnan Said

We use a POMDP model to determine the optimal colonoscopy screening policies that balance the harms (increased costs, disutility, complication risk) and benefits (increased QALYs, colorectal cancer risk) of screening using real data. We find that the optimal policies recommend more aggressive screening and some of the proposed policies outperform current guidelines in terms of QALYs and total costs. We also compare the performances of colonoscopy and other screening methods using our model.

2 - Modeling Latent Therapeutic Demand for Common Variable Immunodeficiency

Jeffrey Stonebraker, Assistant Professor, North Carolina State University, Poole College of Management, Raleigh, NC, United States of America, jsstoneb@ncsu.edu

This research applies methods from decision analysis to model latent therapeutic demand for common variable immunodeficiency (CVID) by integrating the variability in epidemiological data and treatment modalities. This approach is novel to forecast potential demand for the treatment of CVID where supply limitations have reduced the usefulness of sales-based forecasting methods. This approach can help manufacturers and healthcare agencies to ensure adequate treatment for patients with CVID.

3 - Cost-effectiveness of Expanded HIV Treatment among Pregnant Women in Ghana

Adam VanDeusen, Master of Public Health Candidate, Yale School of Public Health, 234 Park Street, New Haven, CT, 06511, United States of America, adam.vandeusen@yale.edu, Elisa Long, Elijah Paintsil, Thomas Agyarko-Poku

Current World Health Organization guidelines recommend short-term antiretroviral treatment for healthy, HIV+ pregnant women (Option B), but a longer course of therapy (Option B+) may reduce vertical transmission in future pregnancies, improve maternal outcomes, and be more cost-effective. We develop a state-transition Markov model, calibrated to HIV demographics and behavior in Ghana, to evaluate alternative treatment scenarios. The analysis aims to help inform HIV treatment policies in Ghana.

4 - Risk Sensitive Optimal Breast Cancer Diagnosis

Mehmet Ayvaci, Assistant Professor, The University of Texas at Dallas, Jindal School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, ayvaci@wisc.edu, Oguzhan Alagoz, Elizabeth Burnside

We investigate the role of risk preferences in the pursuit of optimal diagnostic decisions after mammography. In particular, we develop a risk-sensitive finite-horizon Markov decision process model to maximize total expected utility of a patient where utility in the Von Neumann-Morgenstern sense is defined over survival duration. We perform sensitivity analyses over the parameters of various utility functions and investigate risk behavior as implied by the clinical practice.

■ TC03

03- West 102 B- CC

Joint Session DAS/MAS: Military Decision Analysis

Sponsor: Decision Analysis & Military Applications

Sponsored Session

Chair: Gregory Parnell, United States Military Academy, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu

1 - Air Force Space Command Cyberspace Investment Planning

Gregory Parnell, United States Military Academy, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu

The Air Force Space Command has used multiple objective decision analysis and optimization for over 15 years to develop their space investment plan. Recently,the Air Force cyberspace mission was assigned to the command. This paper presents the new cyberspace value model that was developed and implemented for the Air Force Space Command FY15-24 Investment Planning Process.

2 - Sustaining a Multi-attribute Decision Model Over Time

Jim Lowe, Professor, US Air Force Academy, 2354 Fairchild Dr., Ste. 6H-238, US Air Force Academy, CO, 80840, United States of America, jim.lowe@usafa.edu, Gregory Seely

While the process of developing an initial Multi-Attribute Decision Model is well defined, sustaining such a model from year to year becomes an art. As Decision Makers change, every aspect of the model becomes open for discussion since the new stakeholders have no vested interest in the original model. We present results of a resource allocation model based on 25 years of implementation.

3 - United States Army Brigade Combat Team Model with Demand Reduction Over Time

Mike Teter, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, mteter@mymail.mines.edu, Lee Ewing

The US Army is reducing forces over the next few years and requires a model to help senior leader's to make informed troop level decisions. We present a model to optimally size the United States Army to a certain troop goal while meeting operational, personnel, stationing and budgetary constraints. The model is a mixed integer program with multistage scheduling of demand reduction to a target troop level while lessening the turbulence on soldiers.

4 - New Techniques for Sensitivty Analysis in Multi-objective Decision Analyisis Models

Jeff Weir, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, jeffery.weir@afit.edu

Although a wide variety of sensitivity analysis methods for additive value models appear in the literature, the most commonly used and easily understood is one-way sensitivity analysis. We present two new methodologies, one for one-way and one for n-way sensitivity analysis that address concerns from practice with traditional methods and allow decision makers to quickly investigate how the rank order of alternatives and their values change across the entire feasible region of a weight space.

■ TC04

04- West 102 C- CC

Data Envelopment Analysis III

Cluster: Data Envelopment Analysis

Invited Session

Chair: Paul Rouse, University of Auckland, Department of Accounting & Finance, 12 Grafton Road, Auckland, New Zealand, p.rouse@auckland.ac.nz

1 - Eco-operational Benchmarking: The Case of Aircraft

Nicole Adler, Hebrew University of Jerusalem, Mount Scopus, Jerusalem, 91905, Israel, msnic@huji.ac.il, Gianmaria Martini, Nicola Volta

A new, eco-operational DEA directional distance profit function analyses a data set consisting of current engine aircraft combinations from the perspective of airlines, government agencies and the environment. We explore the incentive schemes that may encourage airlines to choose a fleet that is both profitable and green. Furthermore, we identify the trade-off among pollutants and noise for the aircraft and engine manufacturers involved in research and development based on the DEA methodology.

2 - Educational Efficiency and Productivity in Pennsylvanian Schools

John Ruggiero, University of Dayton, School og Business Administration, Dayton, OH, 45469-2251, United States of America, jruggiero1@udayton.edu, Shae Brennan

In this paper, we apply a public sector productivity model to analyze efficiency, environmental costs and productivity of Pennsylvanian schools. Recognizing the importance of exogenous socio-economic factors of production, we apply the model of Johnson and Ruggiero (2012) to decompose overall productivity.

3 - Towards a Typology of DEA Models

Paul Rouse, University of Auckland, Department of Accounting & Finance, 12 Grafton Road, Auckland, New Zealand, p.rouse@auckland.ac.nz, Lawrence Seiford

As a discipline evolves there comes a time when there is value in clarifying a common structure and classifying its models into similar types. This aids better communication among researchers and identifies areas that are potentially "over or under" researched. It also facilitates better understanding of common structures and problems that gave rise to a family of models. We describe a typology for DEA models as a first step towards meeting the above objectives.

■ TC05

05- West 103 A- CC

Statistical Monitoring and Detection

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Justin Chimka, University of Arkansas, 800 W Dickson St, Fayetteville, United States of America, jchimka@uark.edu

1 - Implementation of Statistical Process Control on Multiple Correlated Nonlinear Profiles

Shih-Hsiung Chou, Kansas State University, Manhattan, KS, 66506, United States of America, cls3415@ksu.edu, Tzong-Ru Tsai, Shing I. Chang

Current state-of-the-art methods in profile analysis involve one profile only. This study examines three methods on monitoring multiple correlated nonlinear profiles using B-spline modeling and multivariate EWMA control charts. A two-profile simulation study is conducted to generate average run lengths for comparison. A real-world data set from a vulcanization process is used to demonstrate the implementation of the proposed methods.

2 - Control Charts for Monitoring Peak Expiratory Flow for Asthma Diagnosis

Amit Mitra, Professor, Auburn University, College of Business, 419 Lowder Building, Auburn, AL, 36849-5266, United States of America, mitraam@auburn.edu, Jayprakash Patankar

Common measures for asthma diagnosis involve peak expiratory flow or forced expiratory volume in one second as indicators of lung function. In this paper, statistical control charts for monitoring peak expiratory flow, obtained from individual samples, over a time period are developed. The proposed control charts are unique to the health care field.

3 - Economic Model of X-bar Chart with Asymmetric Limits

Triss Ashton, University of North Texas, 1155 Union Circle #311160, Denton, TX, 76203-5017, United States of America, triss.ashton@unt.edu, Robert Pavur

This research considers the economic–statistical design of X-bar control charts to minimize the McWilliams' (1989) cost model using asymmetric limits. Sample averages assume Su (unbounded) Johnson distributions. Optimal parameters are compared with symmetric control limits. Lower costs and smaller sample sizes are reported.

4 - Process Abnormality Detection by Process Time Distribution for Optimal Planning

Hiroaki Mori, Osaka University, 2-1 Yamadaoka, Suita, Japan, hiroaki.mori@ist.osaka-u.ac.jp, Hiroshi Morita

We consider finding the undiscovered defects by using mathematical and statistical model in the steel mill product factory. In this study, we focus on the data of processing time at each process since it may correlate with the level of defectiveness. First, we make a mathematical model including "normal" and "abnormal" distribution. Then we estimate the defect rate for each process based on the source of defects, and find the optimal process planning to achieve the defect reduction.

■ TC06

06- West 103 B- CC

Agent-based Modeling and Simulation – Overview and Tutorial

Sponsor: Simulation

Sponsored Session

Chair: Charles Macal, Senior Systems Engineer, Argonne National Laboratory, 9700 S. Cass Ave, DIS - Bldg 221, Argonne, IL, 60439, United States of America, macal@anl.gov

1 - Agent-based Modeling and Simulation – Overview and Tutorial

Charles Macal, Senior Systems Engineer, Argonne National Laboratory, 9700 S. Cass Ave., DIS-Bldg 221, Argonne, IL, 60439, United States of America, macal@anl.gov, Michael North

Agent-based modeling and simulation (ABMS) is a new approach to modeling systems comprised of autonomous, interacting agents. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. Complex adaptive systems, emergent behavior, and self-organization are a few of the notions from ABMS This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects, and the relationship of ABMS to conventional OR.

■ TC07

07- West 104 A- CC

Optimization and Prediction in Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Chun-An (Joe) Chou, University of Washington, 3900 Stevens Way, Seattle, WA, United States of America, joechou@uw.edu

1 - Exact Solution Approaches for Generalizations to the Order-Preserving Submatrix Problem

Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, School of Business, 100 Institute Rd., Worcester, MA, 01609, United States of America, atrapp@wpi.edu

The Order Preserving Submatrix (OPSM) problem is an NP-hard data mining problem that, until recently, has eluded exact solution due to its combinatorial nature. Of late, however, there has been some success in solving the OPSM problem exactly using IP-based approaches. Building upon these, we discuss generalizations of the original OPSM problem, such as how to obtain all statistically significant submatrices, and outline solution approaches. Encouraging computational results are provided.

2 - Creating Lists using the Internet

Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu, Benjamin Letham, Katherine Heller

We want to combine the knowledge of many people (experts) in order to create lists of things that go together, starting from a small seed. This is the same problem that Google Sets was designed to solve. Our algorithm involves a combinatorial search, a large scale clustering algorithm, and an implicit feedback loop.

3 - Multi-task Learning with Heterogeneous Task Relatedness

Yada Zhu, IBM, Yorktown Heights, NY, United States of America, yzhu@us.ibm.com

In many applications of multi-task learning, the tasks form multiple groups, and the relatedness between tasks varies. To address this problem, we propose a general framework, which partitions the input features into 2 sets based on their characteristics, and imposes different constraints on their coefficient vectors to accommodate task grouping.

4 - Optimal Multi-voxel Selection in Pattern Classification of Brain Activity

Chun-An (Joe) Chou, University of Washington, 3900 Stevens Way, Seattle, WA, United States of America, joechou@uw.edu, Kittipat "Bot" Kampa, Art Chaovalitwongse

Recent studies have demonstrated the ability of pattern classification to identify the brain activity with functional MRI (fMRI) technique. A pattern of multiple voxels distributed in the brain conveys discriminative information for cognitive recognition. In our work, we propose a framework to select a set of voxels by introducing a mutual information theory, which is applied to several linear classifiers. We show the experimental result on a multi-class cognition data set.

■ TC08

08- West 104 B- CC

Community-Based Operations Research

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, Dept of Public Policy & Public Affairs, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, michael.johnson@umb.edu

1 - Foreclosed Housing Development Strategy Design using Value-focused Thinking Methods

Michael Johnson, Associate Professor, University of Massachusetts Boston, Dept. of Public Policy & Public Affairs, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, michael.johnson@umb.edu, Rachel Drew, Jeff Keisler, David Turcotte

Community-based organizations often have trouble designing strategies that link achievement of organizational goals to specific actions. We apply value-focused thinking and decision analysis methods to clarify priorities in order to develop and rank strategies for foreclosed housing redevelopment in three urban CBOs. Results and sensitivity analyses illustrate differences across missions and service area characteristics.

2 - Optimal Foreclosed Housing Bidding Policies for Community Development Corporations

Senay Solak, Assistant Professor, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@isenberg.umass.edu, Armagan Bayram

We consider bid/no-bid type decisions for nonprofit community organizations that acquire and redevelop foreclosed properties as part of the societal response to foreclosures. Based on a stochastic dynamic programming formulation, we develop procedures to determine whether a property should be bid on and at what rate. Some numerical analyses are presented based on real-world data.

3 - Decision Modeling for Vacant Lot Acquisition and Redevelopment

Michael Johnson, Associate Professor, University of Massachusetts Boston, Dept. of Public Policy & Public Affairs, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, michael.johnson@umb.edu, Alma Hallulli, Justin Hollander

Cities facing disinvestment and population loss must decide how to assemble and manage large inventories of vacant lots. We develop decision models for parcel acquisition and redevelopment, with a focus on non-residential uses such as urban farming, stormwater management and community gardens. Our model's goals include reducing measures of neighborhood distress, supporting environmental mitigation and ensuring political and social feasibility. We apply our model to data from Baltimore, MD.

4 - A Flow Capturing Facility Location Model for Siting Farmers Markets in an Urban Roadway Network

Jingzi Tan, PhD Student, University of Arizona, 2525 N Los Altos Ave., Tucson, AZ, 85705, United States of America, jingzit@email.arizona.edu, Wei-Hua Lin

Facility location flow capture model is designed to capture maximum flow based on stochastic customer demands and flexible facility capacity. The behavior of the demand in choosing facilities in the network is incorporated into the model for capacity allocation. Two levels of coverage, the primary and the backup, are also captured in the model.

■ TC09

09- West 105 A- CC

Evolutionary Multi-Criterion Optimization - II

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Patrick Reed, Associate Professor of Civil Engineering, The Pennsylvania State University, 212 Sackett Building, University Park, PA, 16802, United States of America, preed@engr.psu.edu

1 - Evolutionary Multiobjective Optimization in Water Resources: The Past, Present, and Future

Joshua Kollat, Research Associate, The Pennsylvania State University, 212 Sackett Building, University Park, PA, 16802, United States of America, juk124@psu.edu, Jon Herman, Patrick Reed, Joseph Kasprzyk, David Hadka

This study contributes a rigorous diagnostic assessment of ten state-of-the-art multiobjective evolutionary algorithms (MOEAs) and highlights key advances that the water resources field can exploit to better discover critical system tradeoffs. The applications tested represent the dominant problem classes that have historically shaped the use of MOEAs in water resources. Recommendations are provided for which modern MOEAs should serve as tools and benchmarks in future water resources studies.

2 - Many Objective Visual Analytics: Decision Support for the Design of Complex Engineered Systems

Matthew Woodruff, PhD Candidate Industrial Engineering, The Pennsylvania State University, 212 Sackett Building, University Park, PA, 16802, United States of America, mjw5407@psu.edu

We apply a new many-objective visual analytics (MOVA) approach to the conceptual design of a General Aviation Aircraft product family design problem. MOVA emphasizes learning through problem reformulation, enabled by visual analytics and many-objective search. Two highly aggregated formulations impose unexpected preferences on solutions, resulting in a myopic view of the problem. In contrast, a many-objective formulation enables the selection of a well-informed solution using visual analytics.

3 - Diagnostic Assessment of the Borg MOEA for Many-objective Product Family Design Problems

David Hadka, PhD Candidate Computer Science, The Pennsylvania State University, 212 Sackett Building, University Park, PA, 16802, United States of America, dmh309@psu.edu, Timothy Simpson, Patrick Reed

This study provides a detailed analysis of the Borg Multiobjective Evolutionary Algorithm (MOEA) on the severely-constrained, ten objective General Aviation Aircraft (GAA) problem. The Borg MOEA utilizes auto-adaptive search to tailor itself to effectively explore challenging problem spaces. This study benchmarks the Borg MOEA relative to other top MOEAs for the GAA problem using control map analysis and the first application of global variance decomposition on a complex real-world problem.

4 - Locating Diverse and Alternative Solutions in Multiobjective Civil Infrastructure Design Problems

Brian Piper, North Carolina State University, 2500 Stinson Drive, Raleigh, NC, United States of America, bepiper@ncsu.edu, Ranji Ranjithan

Discovering alternative solutions may aid exploring a solution space to find trade-offs among competing and conflicting criteria. An evolutionary algorithm for improving decision space diversity and obtaining these alternative solutions is presented using an application to a wastewater management system design problem. Solutions found by the algorithm are analyzed and compared against solutions found by other methods.

■ TC10

10- West 105 B- CC

Advances in Integer Stochastic Programming and Testing Solution Quality

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Honggang Wang, Rutgers University, Piscataway, NJ, United States of America, honggang.w@rutgers.edu

1 - Mixed Integer Simulation Optimization for Oil and Gas Field Development

Honggang Wang, Rutgers University, Piscataway, NJ, United States of America, honggang.w@rutgers.edu

In petroleum industry, because well costs can be extremely high, it is essential that wells be drilled in productive locations and operated effectively. Such development problems are greatly complicated in that the geology of the subsurface is highly uncertain. We propose retrospective optimization using dynamic simplex interpolation for mixed integer simulation optimization associated with oil development problems.

2 - Bias and Variance Reduction for Assessing Solution Quality in Stochastic Programming

Rebecca Stockbridge, University of Arizona, 617 N Santa Rita Ave., Tucson, AZ, 85721, United States of America, rstockbridge@math.arizona.edu, Guzin Bayraksan

We present a computational study of bias and variance reduction methods applied to the optimality gap estimators produced by the Multiple Replications Procedure. Techniques discussed include Latin Hypercube sampling, antithetic variates, and randomized quasi-Monte Carlo for variance reduction, and a probability metrics approach to bias reduction.

3 - An Algorithm for Two-stage Stochastic Programs with Mixed Integer Recourse

Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Anahita Hassanzadeh, Menal Guzelsoy

Due to the complex structure of the mixed integer value function, algorithms for two-stage stochastic linear programs with integer recourse have been con?ned to the pure integer case. We propose an algorithm based on (partial) construction of the value function of the second-stage problem. The algorithm is based on characterizing the local minima of the mixed integer recourse value function.

■ TC11

11- West 105 C- CC

Algorithmic Non-linear Optimization

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Emre Tokgoz, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73071, United States of America, Emre.Tokgoz-1@ou.edu

1 - A Modified Potential Reduction Method for Monotone Complementarity and Convex Programming Problems

Kuo-Ling Huang, PhD Student, Northwestern University, Evanston, IL, United States of America, s9c2p1@u.northwestern.edu, Sanjay Mehrotra

We present a homogeneous algorithm equipped with a modified potential function for the monotone complementarity problem. We show that this potential function is reduced by at least a constant amount if a scaled Lipschitz condition is satisfied. A practical algorithm based on this potential function is implemented in a software package named iOptimize. Computational results show that iOptimize takes fewer iterations than mature solvers Mosek and Ipopt.

2 - Single-source Capacitated Multi-facility Weber Problem – An Iterative Two-phase Heuristic Algorithm

S.M.H. Manzour, University of Oklahoma, Oak 2900, Norman, United States of America, smh.manzour@ou.edu, S.A. Torabi, K. Eshghi

Multi Facility Weber (MFWP)Problem entails determining the locations of a predefined number of facilities in a planar space and their related customer allocations. We focus on Single-Source Capacitated MFWP (SSCMFWP). An iterative two-phase heuristic algorithm is put forward. At the phase I, we aim to determine proper locations for facilities, and during the phase II, assignment of customers to these facilities is pursued. The proposed iterative two-phase algorithm produces promising results.

3 - A New Algorithmic Approach to Solve Mixed Variable Optimization Problems

Emre Tokgoz, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73071, United States of America, Emre.Tokgoz-1@ou.edu

A well known method to solve mixed variable optimization problems is by using interior point method. In this talk I will be introducing a new method to obtain mixed (i.e. discrete and continuous) convexity and optimization results for mixed variable functions with the corresponding algorithms.

4 - A Hierarchical Algorithm for the Planar Single-facility Location Routing Problem

S.M.H. Manzour, University of Oklahoma, Oak 2900, Norman, United States of America, smh.manzour@ou.edu, S.A. Torabi

Location Routing Problem is an important logistical problem that comprises two of the main logistical drivers namely facility location and vehicle routing. We focus on the Planar Single-Facility LRP with Euclidean distance. A hierarchical heuristic-based method is put forward which continuously takes into account information from the routing results while systematically improving the location using the end points of the obtained routes. The proposed method outperformed the existing approaches.

■ TC12

12- West 106 A- CC

Joint Session Optimization IP/ICS: Constraint Programming Methodology and Applications II

Sponsor: Optimization/Integer Programming & Computing Society

Sponsored Session

Chair: Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu

1 - Large-scale Power Restoration

Pascal Van Hentenryck, Professor, University of Melbourne, Melbourne, Australia, pvh@nicta.com.au, Carleton Coffrin, Ben Simon

This paper considers the joint repair and restoration of the electrical power system after significant disruptions. This problem is computationally challenging because, when the goal is to minimize the size of the blackout, it combines a routing and a power restoration component. This paper proposes an hybrid optimization approach based on constraint programming providing high-quality results for infrastructures with more than 24000 components and 1200 damaged items.

2 - Using Cumulative Propagation to Schedule Resources on Projects with Release Dates to Pick-up Goods

Thiago Serra, Operations Research Analyst, PETROBRAS, Avenida Paulista, 901, São Paulo, SP, 01311-100, Brazil, thiago.serra@petrobras.com.br, Fernando J. M. Marcellino, Gilberto Nishioka

The development of constraint-based scheduling solvers has been biased towards the satisfaction of the global constraint cumulative. Hence, a successful use of them to tackle many problems depends on leveraging such constraint in the model. In this work, we consider the scheduling of vessels to convey pipes that will connect offshore oil wells to producing units. To guarantee the loading of pipes by activities scheduled after their release, a qualitative property is modeled with such constraint.

3 - New Development in Google OR-Tools

Laurent Perron, Google, 38 Avenue de l'Opéra, Paris, Fr, 75002, France, lperron@google.com

Google's OR-Tools is a set of libraries that includes a constraint programming solver, a wrapper around linear solvers, and some dedicated graph and flow algorithms. Since the initial presentation, development has been very active and lots of new features have been added to the different solvers. We will take advantage of the INFORMS meeting to present these improvements.

4 - MDD Propagation for Disjunctive Scheduling

Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu, Andre Cire

We present new propagation methods for disjunctive scheduling, based on limited-width Multivalued Decision Diagrams (MDDs). We show how our method can be integrated efficiently with existing propagation algorithms. Experimental results indicate that the MDD propagation can outperform state-of-the-art propagators especially when minimizing sequence-dependent setup times, in certain cases by several orders of magnitude.

■ TC13

13- West 106 B- CC

Solving Hard Problems in Conic Optimization II

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Akiko Yoshise, University of Tsukuba, 1-1-1 Tennnoudai, Tsukuba, 305-8573, Japan, yoshise@sk.tsukuba.ac.jp

1 - A Perturbed Sums of Squares Theorem and its Applications

Masakazu Muramatsu, The University of Elector-Communications, 1-5-1, Chofugaoka, Chofu-shi, Tokyo, 182-8585, Japan, muramatu@cs.uec.ac.jp, Hayato Waki, Levent Tuncel

We show a property of positive polynomials on a compact set with a small perturbation. This theorem implies that the optimal value of the corresponding SDP relaxation with sufficiently large relaxation order is bounded from below and above using the size of the perturbation and the number of variables. The SDP relaxation can be of considerably smaller dimensional than Lasserre's. We present some computational experiments of the SDP relaxation.

2 - Preprocessing and Regularization for Degenerate Semidefinite Programs

Yuen-Lam Vris Cheung, University of Waterloo, 200 University Ave., W, Waterloo, Canada, yl2cheun@uwaterloo.ca, Simon Schurr, Henry Wolkowicz

We propose a backward stable preprocessing technique for semidefinite programming (SDP) that applies the Borwein-Wolkowicz facial reduction process to find a rank-revealing rotation of the problem, resulting in a smaller and well-posed problem that can be solved more accurately by standard SDP solvers. We also examine the implications of the minimum number of facial reductions required, on the theoretical and numerical aspects of solving that instance via interior point methods.

3 - A Primal Barrier Function Phase I Algorithm for Nonsymmetric Conic Optimization Problems

Yasuaki Matsukawa, University of Tsukuba, 1-1-1 Tennnoudai, Tsukuba, Ib, 305-8573, Japan, matsuk50@sk.tsukuba.ac.jp, Akiko Yoshise

We call the set of positive semidefinite matrices whose elements are nonnegative the doubly nonnegative (DNN) cone. Using its symmetric cone representation, the authors showed that the DNN relaxation gives significantly tight bounds for a class of quadratic assignment problems while the computational time is too long. Motivated by the observations, we propose a nonsymmetric primal barrier function Phase I algorithm and provide a sufficient condition for finite termination.

■ TC14

14- West 106 C- CC

Current Issues in Complex Projects

Cluster: Scheduling and Project Management

Invited Session

Chair: Ted Klastorin, Professor, University of Washington, Foster School of Business, Box 353226, Seattle, WA, 98195-3226, United States of America, tedk@u.washington.edu

1 - Planning Uncertain Projects under the Threat of Disruptive Events

Gary Mitchell, Associate Professor, University of Portland, Pamplin School of Business, Portland, OR, 97203, United States of America, mitchelg@up.edu, Ted Klastorin, Issariya Sirichakwal

We study a project defined by a series of stages where the duration of each stage is determined by the level of allocated resources and random work content described by some distribution. There exists the threat of multiple disruptions; each will stop the project for some random time. We define a model that allocates resources over time to minimize expected total costs (defined by resource costs, overhead/indirect costs, and penalty costs). Optimal policies and implications are discussed.

2 - Managing New Product Development Projects In a Competitive Market

Issariya Sirichakwal, University of Washington, Foster School of Business, ISOM Department, Seattle, WA, 98195-3226, United States of America, issars@u.washington.edu, Hamed Mamani, Gary Mitchell, Ted Klastorin

In many markets, the first firm to introduce a new product gains a significant benefit. However, reducing the time-to-market typically requires higher development costs that may offset any first-mover advantage. In this paper, we analyze this trade-off problem in a competitive duopoly market from the perspective of a risk neutral firm that wants to maximize the project's expected total profit. We consider different payoff structures, as well as static and dynamic project scheduling policies.

3 - Optimal Bidding and Investment Strategy in the PPP Competitive Dialogue

Dennis DeClerck, KBI-Operations Management, Katholieke Universiteit Leuven, Leuven, Belgium, Dennis.DeClerck@econ.kuleuven.be, Erik Demeulemeester

Public private partnerships are cutting edge contractual agreements nowadays. This research focuses on the competitive bidding procedure with a game theoretical analysis of the influence of the number of competitors, a company's experience and the government's compensation schemes. Consequently, a rationally optimal approach for the pre-bidding research strategy and the final offer is proposed.

4 - A Reliability Model for the Stochastic RCPSP

Patricio Lamas, KU Leuven, Naamsestraat 69, Leuven, Belgium, Patricio.LamasVilches@econ.kuleuven.be, Erik Demeulemeester

In this presentation we consider the stochastic RCPSP where the stochasticity is incurred because either resource availabilities or activity durations are uncertain. We model the problem as a Chance Constrained Program. The objective is to minimize the project makespan under a predefined reliability level.

■ TC15

15- West 202- CC

Software Demonstration

Invited Session

1 - SAS - Building and Solving Optimization Models with SAS

Ed Hughes, SAS/OR Product Manager, SAS Institute Inc., 500 SAS Campus Dr., Cary NC 27513, United States of America, ed.hughes@sas.com, Rob Pratt

OPTMODEL from SAS provides a powerful, intuitive algebraic optimization modeling language and unified support for LP, MILP, QP and NLP models. We'll demonstrate OPTMODEL's clarity and flexibility in building and solving optimization models, including a review of its newest features. We'll also explore OPTMODEL's integration into a range of SAS data, analytic, and reporting capabilities.

2 - SAS Global Academic Program – Introduction to SAS Rapid Predictive Modeler

Tom Bohannon, SAS Global Academic Program, SAS Campus Dr., Cary NC 27513, United States of America, tom.bohannon@sas.com

This presentation is an introduction to SAS Rapid Predictive Modeler, a component of SAS Enterprise Miner. It provides an overview of the product and provides details on using SAS Rapid Predictive Modeler as part of the predictive modeling process and describes the difference between the basic, intermediate and advanced models that are available in SAS Rapid Predictive Modeler.

■ TC16

16- West 207- CC

Mining Social Media: A Brief Introduction

Cluster: Tutorials

Invited Session

Chair: Pritam Gundecha, Arizona State University, Ira A. Fulton Schools Engineering, Tempe, AZ, United States of America, Pritam.Gundecha@asu.edu

1 - Mining Social Media: A Brief Introduction

Pritam Gundecha, Arizona State University, Ira A. Fulton Schools Engineering, Tempe, AZ, United States of America, Pritam.Gundecha@asu.edu, Huan Liu

The pervasive use of social media has generated unprecedented amounts of social data. Social media data is vast, noisy, unstructured, and dynamic in nature, thus novel challenges arise. This chapter reviews the basics of data mining and social media, introduce representative research problems, illustrates the application of data mining to social media using examples, and describes some projects of mining social media for "humanitarian assistance and disaster relief" for real-world applications.

■ TC17

17- West 208 B- CC

Communication Instruction in Business & Industrial Engineering: Tools & Recommendations for Your Own Setting

Sponsor: INFORM-ED

Sponsored Session

Chair: Judith Norback, Dir. of Workplace & Academic Communication, Stewart School of ISyE,Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, jnorback@isye.gatech.edu

Co-Chair: Patrick Noonan, Professor in the Practice of Decision & Info. Analysis, Emory University, 1300 Clifton Road NE, Goizueta Business School, Atlanta, GA, 30322, United States of America, pnoonan@emory.edu

1 - Problem-driven Communication: Best Practices from the Consulting Profession

Patrick Noonan, Professor in the Practice of Decision & Info. Analysis, Emory University, 1300 Clifton Road NE, Goizueta Business School, Atlanta, GA, 30322, United States of America, pnoonan@emory.edu

Students can learn to communicate effectively and persuasively by adopting methods used by management consultants, and letting the problem content to the talking: relentlessly asking "so what," creating logic trees (the Pyramid Principle), assembling clear story-lines, and practicing good slide craft. We showcase examples from an experiential-learning project course.

2 - Building and Measuring Business Communication Competency

Karen Eboch, Senior Lecturer, Bowling Green State University, Department of Management, BAA 3020, Bowling Green, OH, 43537, United States of America, eboch@bgsu.edu

Developing and evaluating communication competency is a key issue for colleges preparing students for career success and business programs dealing with AACSB accreditation. Given today's business environment, communication skills go beyond basic written and oral proficiency to include more data driven tools and team effectiveness tips. Effective methods of building and measuring these communication competencies across a four year undergraduate business program curriculum will be shared.

3 - Integrating Communication in an Industry Sponsored Capstone Course

Anita Vila-Parrish, North Carolina State University, Campus Box 7906, Raleigh, NC, 27695, United States of America, arvila@ncsu.edu, Julie S. Ivy, Sarah Egan Warren

This talk will be focused on threading communication tools throughout an industrial engineering capstone course. In this semester-long course, projects are industry sponsored which require students to communicate to different audiences (internal and external). The course leverages industry standard templates and project management methods to facilitate communication from concept to implementation phase.

4 - A 5-Stage Model for Integrating Communication Skills into Business Curriculums
Lyle Benson, Grant MacEwan University, Edmondton, AB, Canada, bensonl@macewan.ca

This presentation describes the integration of writing and presenting communication skills into the MacEwan University BCom program and courses via a five-phase model: 1. Institutional Preparation Process, 2. Curriculum Development Process, 3. Professional Skills and Curriculum Mapping Integration Process, 4. Evaluation Process, and 5. Faculty Integration Process.

■ TC18

18- West 208 A- CC

Continuous and Discrete Optimization Software: State-of-the-art

Sponsor: Optimization/Computational Optimization and Software
Sponsored Session

Chair: Hans Mittelmann, Arizona State University, School of Math and Stats, Box 871804, Tempe, AZ, 85287-1804, United States of America, Mittelmann@asu.edu

1 - Performance of Commercial and Noncommercial Optimization Software
Hans Mittelmann, Arizona State University, School of Math and Stats, Box 871804, Tempe, AZ, 85287-1804, United States of America, Mittelmann@asu.edu

We will report on selected results from our ongoing benchmarking effort. Discrete benchmarks are based on MIPLIB2010 and own selections. Continuous benchmarks include LP, QP, QCQP, SOCP, and SDP problems and solvers.

2 - The SCIP Optimization Suite 3.0 - It's all in the bag!
Gerald Gamrath, Research Assistant, Zuse-Institut Berlin, Takustr 7, Berlin, 14199, Germany, gamrath@zib.de, Timo Berthold, Ambros Gleixner, Stefan Heinz, Marc Pfetsch, Matthias Miltenberger, Thorsten Koch, Stefan Vigerske, Kati Wolter, Dieter Weninger, Yuji Shinano, Michael Winkler

We present the SCIP Optimization Suite, a tool for modeling and solving optimization problems. It comes with the modeling language ZIMPL and the LP solver SoPlex and is one of the fastest MIP solvers available in source code. Additionally, it can solve more optimization problems including non-convex MINLP and supports branch-and-price. We report on current developments and new features in the 3.0 release, including enhanced MINLP support, exact integer programming, and parallelization.

■ TC19

19- West 211 A- CC

Disease Transmission

Contributed Session

Chair: David Hutton, University of Michigan, 1415 Washington Heights, SPH II: M3525, Ann Arbor, MI, 48109, United States of America, dwhutton@umich.edu

1 - Calibration of an Agent-based Simulation for Clostridium Difficile Transmission and Control
James Codella, University of Wisconsin-Madison, 3270 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, codella@wisc.edu, Oguzhan Alagoz, Nasia Safdar

Clostridium difficile infection (CDI) affects 500,000 Americans every year, and causes nearly 20,000 deaths annually. We propose an agent-based simulation to model the transmission dynamics and strategies to control CDI. Furthermore, we describe methods to calibrate unknown parameters and validate assumptions for an agent-based simulation.

2 - Probabilistic Risk Assessment of Influenza Control Strategies using an Agent-based Model
Elnaz Karimi, Graduate Research Assistant, Concordia University, Industrial Engineering, 1455 de Maisonneuve Blvd W, EV-S3.330, Montreal, QC, H3G 1M8, Canada, karimi.lnz@gmail.com, Ali Akgunduz, Ketra Schmitt

We introduce an agent-based model to simulate the behavior of each individual in a university population during a seasonal influenza outbreak considering both pharmaceutical and non-pharmaceutical interventions. We then conduct a cost-effectiveness analysis to find the best combination of interventions to control the spread of influenza in the target population. Finally we evaluate the results of this model within the context of probabilistic risk assessment (PRA).

3 - Modeling the Effect of Nurse as a Transmitter on Hospital Acquired Infections
Evrim Didem Gunes, Koc University, Rumeli Feneri Yolu, Istanbul, Turkey, egunes@ku.edu.tr, Yasin Arslan, Lerzan Ormeci

We first analyze data from the ICU of a public hospital and show the effect of neighboring beds in probability of acquiring a colonization or infection in the ICU. Further, we model the ICU acquired infections in the ICU as a Markov Process, accounting for the role of the nurse. We use numerical experiments to investigate policies to reduce infections. Nurse to patient ratio and size of the ICU are major factors that are analyzed.

4 - A Stochastic Model for Epidemics using Spatial Games
Songnian Zhao, PhD Student, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, songnian@ksu.edu, Chih-Hang Wu, Zhenzhen Shi

We present a stochastic model describing the transmission of infectious diseases, considering the individuals' spontaneous responses to the epidemics using the spatial game. The study explores the significant factors impacting the dynamics of infectious disease and a case study is given to predict the spread of infectious diseases.

5 - Effectiveness and Cost-Effectiveness of Early Vaccination for a Human Influenza A (H5N1) Pandemic
David Hutton, University of Michigan, 1415 Washington Heights, SPH II: M3525, Ann Arbor, MI, 48109, United States of America, dwhutton@umich.edu, Nayer Khazeni, Ine Collins

Influenza A (H5N1) is an emerging pandemic threat, yet traditional vaccine development and delivery may take months. We use a mathematical model of pandemic influenza spread to evaluate the health and economic benefits of interventions to speed up the vaccine development and delivery process. Both the health and economic benefits of delivering the vaccine a few months earlier can be substantial. Sensitivity analysis shows conditions that may make speedy vaccine delivery less valuable.

■ TC20

20- West 211 B- CC

Information in Health Care

Contributed Session

Chair: Subodha Kumar, Mays Business School, Texas A&M University, College Station, TX, 77843, United States of America, subodha@tamu.edu

1 - Dynamics of Change: Institutional Logics of Adoption and Use Health IT
Anthony James Baroody, Lecturer, Rochester Institute of Technology, E. Philip Saunders College of Business, 107 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, jbaroody@saunders.rit.edu, Sean Hansen

This study extends earlier research analyzing institutional logics at play in the adoption of electronic health records (EHRs) within the U.S. healthcare system. Institutional logics are combined with system dynamics to examine the interplay of multiple institutional logics upon EHR adoption. Complementary and conflicting institutional logics are examined in a systems perspective to evaluate implications for the emergence of an IT-intensive U.S. healthcare system.

2 - Analyzing Process Outcomes and Care Coordination with Digitization
Yi-Chin Lin, Carnegie Mellon University, 5000 Forbes Ave., Hamburg Hall, Pittsburgh, PA, 15213-3890, United States of America, yichinl@andrew.cmu.edu, Rema Padman, Lakshmanan Krishnamurti

Although broadly advocated, the impact of Health IT remains unclear. This study analyzes data from clinician surveys and electronic medical records to evaluate the impact of digitization of paper-based, individual pain plans on process outcomes and care coordination in management of children with sickle cell pain presenting in emergency department.

3 - Electronic Medical Record (EMR) and Physician Career Satisfaction
Fei Li, PhD, University of Southern California, USC, Los Angeles, CA, 90089, United States of America, feil@usc.edu

This study uses survey to assess the association of physician career satisfaction and potentially significant factors of EMR system and implementation process. Based on Technology of Acceptance and Use of Technology (UTAUT) model and successful cases studies, the factors are developed in four constructs: perceived usefulness of EMR, perceived ease of use, social influence and facilitating conditions during implementation process. Factor analysis and logistic regression are performed.

4 - Physicians interactions with Electronic Health Records in Primary Care

Onur Asan, UW-Madison, 1513 University Avenue, Madison, WI, 53705, United States of America, onrasan@gmail.com, Enid Montague

It is essential to design technologies and systems that promote appropriate interactions between physicians and patients. This study explored how physicians interact with EHRs to understand the qualities of the interaction between the physician and the EHR that may contribute to positive physician-patient interactions.Future research on this topic and design strategies for effective health information technology in primary care are also discussed.

5 - Healthcare Information Exchange and Interoperability: A Game-Theoretic Approach

Subodha Kumar, Mays Business School, Texas A&M University, College Station, TX, 77843, United States of America, subodha@tamu.edu, Arun Sen, Emre Demirezen

US government reimburses healthcare information exchanges (HIEs) and healthcare providers if they join HIE networks. HIEs also offer other value-added services for additional fees. Benefits and costs of providers depend on the service levels they receive. We discuss when providers should join HIE, and the level of service they should request. On the other hand, HIEs maximize their profits considering the cost of different services and deciding on the prices of these service offerings.

■ TC21

21- West 212 A- CC

Disaster and Evacuation Management

Sponsor: Optimization/Networks

Sponsored Session

Chair: Chrysafis Vogiatzis, University of Florida, Weil 303, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, chvogiat@gmail.com

1 - Evacuation Planning for Livestock in a Case of a Nuclear Power Plant Accident

Ruriko Yoshida, University of Kentucky, 325D MDS building, Lexington, KY, 40506, United States of America, ruriko.yoshida@uky.edu, Ines Aviles-Spadoni, Chrysafis Vogiatzis, Shigeki Imamoto

Development of a mathematical formulation of an evacuation plan for livestock around a nuclear power plant is essential for farmers to lessen financial, emotional impacts from losing their animals. So we propose two mathematical models for evacuation plan for livestock via integer programming (IP) over networks. Due to NP-completeness of IP, we propose a heuristic algorithm for our problem. We end with simulation results/experiments with the map near the Fukushima Daiichi nuclear power plants.

2 - Clustering Techniques and Hybrid Algorithms in Evacuation Management

Chrysafis Vogiatzis, University of Florida, Weil 303, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, chvogiat@gmail.com, Panos Pardalos, Jose L. Walteros

Evacuation management is of utmost importance for the well-being of every modern society. In this presentation, we emphasize on large-scale evacuation of metropolitan areas. The problem, being extremely large, is almost impossible to solve without employing a decomposition of the network at hand. We present an approach to effectively decompose the problem in a series of smaller evacuation problems and, then, effectively combine the optimal solutions provided by the approximate subproblems.

3 - Optimal Allocation of Renewable and Non-Renewable Resources in Disasters

Shengbin Wang, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, seraph719@gmail.com, Lei Lei

We consider an allocation problem over a two-stage supply chain network with renewable and non-renewable resources, which is encountered from the practice of providing medical service to people in the affected area by a disaster. This situation is modeled as a MIP to coordinate both resources to minimize the total tardiness. We analyze the problem properties and based on that we provide a heuristic algorithm to solve it efficiently.

4 - Multi-commodity Stochastic Network Design: Without Conservation-of-flow on the Design Variables

Xin Wang, PhD Student, Lancaster University Management School, House 172, Graduate College, Lancaster University, Lancaster, LA2 0PJ, United Kingdom, x.wang32@lancaster.ac.uk, Stein Wallace

We present a stochastic, time-dependent, capacitated, multi-commodity service network design problem in which periodic, cyclic schedules are built for a number of vehicles. We aim to find and illustrate the underlying structures of solutions based on stochastic demand by studying the optimal solutions to the stochastic network design problem and comparing them with deterministic counterparts, and to provide insight into developing a heuristic for large problems.

■ TC22

22- West 212 B- CC

Computational Integer Programming

Sponsor: Computing Society

Sponsored Session

Chair: Yan Xu, Analytical Solutions Manager, SAS Institute Inc., SAS Campus Drive, Cary, SC, United States of America, Yan.Xu@sas.com

1 - Recent Advances in the Xpress MIP solver

Oliver Bastert, FICO, Starley Way, Birmingham, United Kingdom, OliverBastert@fico.com, Michael Perregaard

We will present some of the recent developments in the Xpress MIP solver, with particular emphasis on heuristics. Modellers continually push the boundaries on the size of problems that can be solved and is often satisfied with a solution that is "good enough". This talk will focus on the developments in Xpress to address such problems.

2 - Gurobi Presolve

Robert Bixby, CEO and President, Gurobi Optimization Inc., 3733-1 Westheimer Rd., Houston, TX, United States of America, bixby@gurobi.com, Zonghao Gu, Ed Rothberg

Presolve refers to that step before solution of an optimization model in which an attempt is made to simplify a model. For LPs these simplifications remove "extraneous" parts of the model, but for MIPs the changes can be more fundamental, producing a strengthened model, and this strengthening can make the difference between a model being solvable and hopeless. We will examine Gurobi presolve, including the effects of some of the more interesting new reductions.

3 - Developments in SAS MILP Solver

Amar Narisetty, Operations Research Specialist III, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Amar.Narisetty@sas.com

The SAS MILP solver implements a branch-and-cut algorithm for solving mixed integer linear programs. In this talk, we give an overview of the recent improvements that are incorporated in the SAS MILP solver. These improvements are in presolve, LP, cuts, heuristics and a new option for decomposable MIPs. We present computational results to demonstrate the effectiveness of these improvements.

4 - Recent Improvements in IBM ILOG CPLEX Optimization Studio

Laszlo Ladanyi, CPLEX R&D, IBM, P.O. Box 800, Lakeville, CT, 06039, United States of America, ladanyi@us.ibm.com

We present new features that have been added to IBM ILOG CPLEX Optimization Studio and give benchmarking results that demonstrate the performance improvements in CPLEX 12.5.

■ TC23

23- West 212 C- CC

Innovation in Analytics Award: Semi-finalist Presentations III

Sponsor: Analytics

Sponsored Session

Chair: Michael Gorman, University of Dayton, Dayton, OH, United States of America, michael.gorman@udayton.edu

1 - Insurance Agency Productivity, Efficiency and Prospecting

Mark Grabau, IBM, United States of America, Elizabeth Riczko

Insurance companies desire a fact-based, decision-making process for managing their agency distribution channel such that it is productive and profitable. We present an approach that combines Data Envelopment Analysis, Predictive Modeling, Collaborative Filtering, and Reporting to objectively meet that need. Results are discussed as well as areas for future research and on-going improvements.

2 - A System for Optimizing Advance Acquisition of Right-of-Way for Highways at TxDOT

Ron Hagquist, Texas Transportation Institute (TTI), 125 E. 11th Street, Austin, TX, 78701, United States of America, Dong Hun "Don" Kang, Carlos M. Chang-Albitres, Paul E. Krugler, Sergiy Butenko, Richard M. Feldman, Reza Seyedshohadaie

Acquiring highway right-of-way well in advance of actual construction can avoid substantial escalation of the cost of purchasing parcels. However, this money could also be used to advance other aspects of existing projects underway. A decision-support system combining simulation and optimization was developed for field use analyzing this classic tradeoff situation, with an optimal minimum-cost solution depending on the parameters of the specific situation.

3 - Sustainable Investment Decision Analysis: Integrated Techno-economic Analysis for a Biofuel Initiative

Scott Mongeau, Principal Consultant, Nyenrode Business University

An integrated modeling and assessment technique known as techno-economic analysis is emerging as a promising method to address the inherent complexity associated with sustainable energy project decision management. Via a practical case involving a bioethanol R&D project for a biomaterials conglomerate, key considerations related to techno-economic decision analysis are examined. A unique process-oriented analysis approach was composed and applied to guide decision making for the firm which resulted in the launch of a collaborative partnership venture to deploy an experimental cellulosic biofuel plant. The integrated approach, involving NPV modeling, Monte Carlo analysis, and Real Options Analysis (ROA), is discussed in terms of methodological, technical, and practitioner considerations.

4 - Data-driven Appointment Scheduling in the Presence of No-shows

Michele Samorani, Alberta School of Business, University of Alberta, Edmonton, AB, Canada, samorani@ualberta.ca, Linda LaGanga

We consider the problem of scheduling outpatient appointments in the presence of no-shows. Predictive analytics is used to forecast the show outcome of appointment requests, which are optimally scheduled given this prediction. Descriptive analytics is used to interpret the solutions of the scheduling problem in order to derive a heuristic policy, which, depending on the show rate and on the prediction quality, outperforms the reigning scheduling policy, open access. Prescriptive analytics is used to identify the conditions under which one should adopt overbooking or same-day scheduling. We validate our findings on the data set of a large mental health center.

■ TC24

24- West 213 A- CC

Game-Theoretic Applications in Healthcare

Sponsor: Health Applications Society

Sponsored Session

Chair: Murat Kurt, Assistant Professor, University at Buffalo, SUNY, University at Buffalo, North Campus, 415 Bell Hall, Buffalo, NY, 14260, United States of America, muratkur@buffalo.edu

1 - Optimal Design of the Annual Influenza Vaccine with Autonomous Manufacturer

Osman Ozaltin, Assistant Professor, University of Waterloo, 200 University Avenue West, CPH 3671, Waterloo, ON, N2L 3G1, Canada, oozaltin@uwaterloo.ca, Andrew Schaefer, Oleg Prokopyev

Seasonal influenza is a major public health concern, and the first line of defense is the flu shot. We model the annual influenza strain selection problem as a bilevel stochastic mixed-integer program. Calibrated over publicly available data, our model determines the optimal flu shot composition and production in a stochastic and dynamic environment. We also analyze the effects of yield uncertainty, price, and production cost on the flu shot production.

2 - Coordinating Vaccine Markets: Operational Issues and Network Effects

Elodie Adida, University of California at Riverside, School of Business Administration, Riverside, United States of America, elodieg@ucr.edu, Hamed Mamani, Debabrata Dey

Vaccines are the most effective means for preventing infectious diseases. However, negative network externalities on the consumption side and operational issues (such as yield uncertainty) on the supply side do not provide the incentives required to reach the socially optimal vaccine coverage. We investigate how a central policy-maker can induce a socially optimal coverage through the use of a two-part subsidy scheme.

3 - DMA-POMDP: A Multi-agent Framework for Decentralized Control and its Application to Outbreak Response

Emine Yaylali, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, eyaylal@ncsu.edu, Julie S. Ivy

We present a multi-agent partially observable Markov decision process framework (DMA-POMDP) for decentralized control of multiple agents under uncertainty. DMA-POMDP can be applied to problems where agents have partial information about both other agents and system state and communication between agents is explicitly formulated. We apply the DMA-POMDP framework to a public health setting where local and state health departments seek to optimize the timing of response under a disease outbreak.

4 - Equilibrium Stability vs Payoff Efficiency in Prearranged Paired Kidney Exchanges

Murat Kurt, Assistant Professor, University at Buffalo, SUNY, University at Buffalo, North Campus, 415 Bell Hall, Buffalo, NY, 14260, United States of America, muratkur@buffalo.edu, Mark Roberts, Utku Unver, Andrew Schaefer

Paired kidney exchanges (PKE) alleviate the shortage in the supply of kidneys for transplantation. We model patients' transplant timing decisions in a PKE as a stochastic game and address the trade-off between the payoff efficiency and the stability of the equilibria against patients' joint deviations. To characterize a socially efficient stable equilibrium, we formulate an MILP representation of the resulting equilibrium conditions. We present computational results using clinical data.

■ TC25

25- West 213 B- CC

Healthcare Modelling

Sponsor: Health Applications Society

Sponsored Session

Chair: Michael Carter, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, mike.carter@utoronto.ca

1 - Cross-sector Patient Flow Model: Towards a Conceptual Framework for Patient Flow Management

Ali Vahit Esensoy, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ali.esensoy@utoronto.ca, Michael Carter

Developing policies from a system-wide perspective is becoming increasingly important as health authorities promote interventions, which have multi-sector implications. We present a system dynamics model of patient flows between health system sectors, which relates policy levers, performance measures and flow characteristics, effectively providing a conceptual framework for patient flow through the healthcare system. Examples are given on the model's applications in policy making in Ontario.

2 - A Generalized Perioperative Simulation as a Decision and Diagnostic Tool

Daphne Sniekers, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, daphne.sniekers@mail.utoronto.ca, Michael Carter

A generalised, simulation-based perioperative decision support tool has been designed to inform tactical level decision making. The primary intention of the tool was to evaluate various decisions regarding the effect of scheduling and availability of perioperative resources on patient flow. Through application at six hospitals, it was found that the tool is not only useful for decision making, but also to diagnose various efficiency issues that lead to poor outcomes.

3 - A Decision Support Tool for Hip and Knee Osteoarthritis Health Service Delivery

Sonia Vanderby, Assistant Professor, University of Saskatchewan, 57 Campus Drive, Saskatoon, SK, S7N 5A9, Canada, sonia.vanderby@usask.ca, Deborah Marshall, Robert Lee, Paul Rogers, Michael Carter, Tom Noseworthy

The rising prevalence of osteoarthritis is increasing the burden on already strained healthcare resources. Alberta Health Services managers lack tools to help inform difficult resource and process decisions. We present a system dynamics model developed as a decision support tool for the hip and knee osteoarthritis system. Simulating patients from disease onset through both medical and surgical management, the model provides insight into the resources needed to meet current and future demand.

4 - Optimization-based Tools for Residency Scheduling
Amy Cohn, University of Michigan, Ann Arbor, MI, United States of America, amycohn@umich.edu, Brian Jordan, Young-Chae Hong

The scheduling of medical residents is a complex combinatorial optimization problem that is often solved manually by Chief Residents. We present a MIP-based approach that dramatically reduces scheduling time while eliminating errors that are ubiquitous in practice. More importantly, the resulting schedules are better designed to ensure safe and quality patient care and better educational experiences for the residents.

■ TC26

26- North 221 A- CC

Operations Economics: Dynamic Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu

1 - A Supplier's Response to Auditing and Incentives for Social and Environmental Performance
Terry Taylor, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States of America, taylor@haas.berkeley.edu, Erica Plambeck, Qinqin Zhang

Firms audit their suppliers' labor conditions and environmental performance, and even provide financial incentives for such performance. Unfortunately, suppliers often respond with deception - by hiding noncompliance. We identify conditions under which higher auditing effort or financial incentives backfire - causing the supplier to invest less in compliance. We also identify conditions under which a buyer should commit to invite a third party to audit is supplier and to publicize violations.

2 - Promoting Competition in Repeated Procurement Auctions
Gabriel Weintraub, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, gyw2105@columbia.edu, Sachin Adlakha

Most of the literature in auctions assumes a one shot interaction between the auctioneer and the bidders. However, in many real-world procurement settings there are many repeated interactions and suppliers make entry, exit, and other decisions over time. We introduce a novel dynamic model of repeated procurement auctions with these features. We consider commonly used mechanisms to enhance competition (subsidies, split-awards, set-asides) and study which ones lead to a lower procurement cost.

3 - Dynamic Price Signaling Strategies
Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu

In this talk, I will discuss dynamic pricing strategies of a seller that is privately informed about the quality of an asset.

4 - Social Norms in Queues
Gad Allon, Northwestern University, 2001 Sheridan Rd, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

In many service settings customers have adopted self-enforcing priority rules. While in some cases, all customers are served according to the order in which they arrive, cutting the line is possible in other systems. We provide conditions under which these intrinsic priorities may emerge. Our results suggest that when priority rules are not centrally managed, they depend on arrival and service rates, customer heterogeneity and patience.

■ TC27

27- North 221 B- CC

Interface of Operations and Finance

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Guoming Lai, University of Texas at Austin, 1 University Station, Austin, TN, United States of America, guoming.lai@mccombs.utexas.edu

Co-Chair: Song Alex YangAssistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, sayang@london.edu

1 - The Impacts of Inventory Sharing on Commodity Procurement
Seung-Jae Park, Universityof Texas, Austin, 2110 Speedway Stop B6500, Austin, TX, 78712, United States of America, Seung-Jae.Park@phd.mccombs.utexas.edu, Guoming Lai, Sridhar Seshari

We consider two firms that use a common commodity input to satisfy stochastic demands in a multi-period setting. The firms procure the commodity as well as sell excess inventory through either the spot or the forward market. The firms also share the commodity. We characterize the firms' equilibrium procurement policies. We show inventory sharing is always beneficial. We numerically find that the option to share inventory may either increase or decrease the firms' optimal inventory levels.

2 - Which Operational Parameters Matter for the Valuation of Electricity Storage?
Yangfang Zhou, PhD Candidate, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, United States of America, yangfang@andrew.cmu.edu, Nicola Secomandi, Jay Apt, Alan Scheller-Wolf, Stephen Smith

We study how the market valuations of three grid-scale battery electricity storage technologies depend on their operational characteristics, such as the number of executable cycles and the magnitude of the charging and discharging rates. We discuss which of these characteristics are most valuable for each technology. We also investigate how the frequency of decision making affects our findings.

3 - Improving Operational Competitiveness through Bankruptcy
Song Alex Yang, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, sayang@london.edu, Rodney Parker, John Birge

We study how a distressed firm can use bankruptcy reorganization to improve operational competitiveness and how this strategy influences its competitor, supplier, and creditors. A successful reorganization allows the bankrupt firm to lower its operational cost and that this outcome improves the efficiency of the chain overall. However, in the long run, easy reorganization benefits the supplier and the non-distressed competitor but may hurts the distressed firm.

4 - Going Out of Business: Applying Management Science to Retail Chain Liquidation
Nathan Craig, Doctoral Candidate, Harvard Business School, Soldiers Field Rd, Boston, MA, 02163, United States of America, ncraig@hbs.edu, Ananth Raman

Retail chain liquidation is the time-constrained sale of inventory located at multiple retail locations. The retail industry depends on chain liquidation to allow investors to recover funds from failed ventures and to enable managers of going concerns to divest stores in efforts to improve performance. This paper introduces techniques for increasing the efficiency of retail chain liquidation. Further, this paper demonstrates the performance of these techniques across multiple liquidations.

■ TC28

28- North 221 C- CC

Global Health Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Jeremie Gallien, London Business School, Regent's Park, London, NW14SA, United Kingdom, jgallien@london.edu

1 - Optimal Food Aid Policies for Minimizing Childhood Malnutrition in Sub-Saharan Africa
Lawrence Wein, Professor, Stanford University, Graduate School of Business, Stanford, CA, United States of America, lwein@stanford.edu, Yan Yang, Jan Van den Broeck

Using longitudinal data from 5167 children in the Democratic Republic of Congo, we model the evolution of height and weight from birth to age five as a bivariate integrated Ornstein-Uhlenbeck process. We find food aid policies that minimize the disability-adjusted life-years (DALYs) related to wasting and stunting, and compare our policies to the currently recommended policies.

2 - Improving Laboratory Networks for Early Infant HIV Diagnosis in Sub-Saharan Africa
Jeremie Gallien, London Business School, Regent's Park, London, NW14SA, United Kingdom, jgallien@london.edu, Sarang Deo, Jonas Oddur Jonasson

Many sub-Saharan countries experience high mortality rates among HIV+ infants. An important cause is the long delay to obtain diagnosis due to ineffective systems for transporting and analyzing blood samples and communicating results. Using a representative dataset combining information from several countries, we develop a queueing network model to estimate the potential public health impact of operational interventions such as clinic assignment optimization and segmentation of samples.

3 - Network Externality in Allocation of Point-of-care (POC) Diagnostic Tests in Developing Countries

Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, Sarang_Deo@isb.edu, Milind Sohoni

POC diagnostic devices aim to eliminate diagnostic delays and improve patient retention in developing countries. We develop an optimization model for the allocation of a limited number of devices over a network of clinics. We study the impact of network externality – allocation to one clinic changes the delay experienced at other clinics – which is not accounted for in simple thumb rules used in practice. We apply our results to an infant HIV diagnosis program in a sub-Saharan country.

■ TC29

29- North 222 A- CC

Appointment Sequencing and Scheduling

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Rachel Chen, University of California at Davis, Graduate School of Management, Davis, United States of America, rachen@ucdavis.edu

1 - Appointment Scheduling under Patient Preference and No-show Behavior

Nan Liu, Columbia University, 600 W 168th St., Room 603, New York, NY, 10032, United States of America, nl2320@columbia.edu, Jacob Feldman, Huseyin Topaloglu, Serhan Ziya

We develop a model to schedule patient appointments over time. On each day, we decide which appointment days to make available for the patients who raise appointment requests on the current day. Our model explicitly considers patient preference and no-show behavior. We derive the optimal static policies and show that they have a performance guarantee which improves as demand increases. We also develop dynamic policies which utilize the current state information and improve over the static ones.

2 - Appointment Scheduling with Nonlinear Waiting Costs and No-shows

Michael Pinedo, Professor and Chair, New York University, Stern School of Business, 44 West 4th Street, New York, NY, 10012, United States of America, mpinedo@stern.nyu.edu, Christos Zacharias, Kangbok Lee

Consider an appointment scheduling problem with a fixed number of slots and a number of customers to be assigned to the slots. Each customer has a weight and a given probability of not showing up. The waiting cost function of the customers is nonlinear. We establish conditions under which certain priority rules are optimal for certain segments of the schedule.

3 - Sequencing Surgeries for Operating Rooms with Inventory Approximations

Jiawei Zhang, Stern School of Business, New York University, New York, NY, United States of America, jzhang@stern.nyu.edu, Ying Rong, Ho-Yin Mak

Managing surgery appointments for operating rooms (ORs) is a challenging task due to randomness in surgery durations. We propose new heuristics for the problem of surgery sequencing, i.e., determining the order in which a list of surgeries should be performed in an OR. The fundamental idea behind the development of these heuristics is the structural connection between OR appointment scheduling and stochastic inventory control in serial supply chains.

4 - Appointment Sequencing: Is the Smaller-Variance-First Rule Optimal?

Zhichao Zheng, PhD Candidate, National University of Singapore, 1 Business Link, Biz 2 Building, #B2-03, Singapore, 117592, Singapore, zhichao@nus.edu.sg, Qingxia Kong, Chung-Yee Lee, Chung Piaw Teo

We study the design of appointment system to minimize the expected waiting time of patients and overtime of the doctor when patients' service durations are random. It is widely conjectured that sequencing patients with smaller variance in service time first might be optimal. We challenge this conjecture and show that it may not be optimal in general. We investigate the complexity of the problem and propose a robust planning framework. Some important insights are drawn from numerical analysis.

■ TC30

30- North 222 B- CC

Resource Allocation

Contributed Session

Chair: Alexander Galenko, Operations Research Analyst, AgileAssets, Inc, 3144 Bee Caves Rd, Austin, TX, 78746, United States of America, agalenko@agileassets.com

1 - Fair Allocation of Scarce Resources after a Tornado – Case Study Norman Area

Mohammad Nikoukar, Graduate Student, The University of Oklahoma, 202 W Boyd Street, Carson Engineering Center, Room 35, Norman, OK, 73019, United States of America, mohammad.nikoukar@ou.edu

This article focuses on the allocation of scarce resources after a natural disaster, case study a tornado in Norman, Oklahoma area. Since the scarce recourses are vary in different situations, it is really critical to assign them correctly. Fair allocation approach can be helpful to consider both rescuers and rescuees. The most important factor in rescuees perspective, is the number of people that be helped but rescuers like to experience uniform work load distribution.

2 - Advanced Aggregate Planning Decisions with Optimal Balance between Demand and Supply

Kris Lieckens, Dr., KU Leuven, Naamsestraat 69, Leuven, 3000, Belgium, kris.lieckens@econ.kuleuven.be, Nico Vandaele

An advanced multi-product, multi-routing system is presented to support aggregate planning decisions regarding product-mix, production volume and capacity. Given demand in multiple periods, the model decides on the optimal periodic quantity to be assigned to each alternative, while taking into account relevant costs and variabilities in demand and production. The methodology is a queueing network with estimates for lead time distribution and service level. Managerial insights are shown.

3 - A Resource Allocation Model for Assigning Boats to Stations in the United States Coast Guard

Christie Nelson, Rutgers University, 640 Bartholomew Rd., Piscataway, NJ, 08854, United States of America, cgrewe@eden.rutgers.edu, Matthew Oster, Endre Boros, Todd Aikins, Thomas Sharkey, William M. Pottenger, Paul Kantor, Fred Roberts, Chad Conway, Kevin Hanson, Patrick Ball, Kim Babcock, James Wojtowicz

We present a resource allocation model for assigning boats of varying types to stations within the United States Coast Guard (USCG), so as to meet mission-hour requirements and budget constraints. We discuss an initial integer programming formulation which can be solved to near-optimality on instances which include a small subset of stations (e.g. a single district). We then demonstrate a decomposition algorithm for handling the entire USCG data set. Numerical test results will be presented.

4 - Cross-training Decisions for a Multi-Shift Workforce Allocation Problem

Aditya Gandhi, Graduate Research Assistant, Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, adg2351@rit.edu, Scott Grasman, Shrikant Jarugumilli

This work develops a cross-training framework and applies it to the multi-shift workforce allocation problem. Two different approaches are being evaluated and discussed. The first apporach is that of building an integrated model which adds cross-training parameters and scheduling constraints to the problem. The second approach is to develop different cross-training policies and evaluate them to obtain a policy which can best reduce overtime allocations and operational gaps.

5 - Asset Management Models: Model Size Reduction in the Context of Pavement Management System

Alexander Galenko, Operations Research Analyst, AgileAssets, Inc, 3144 Bee Caves Rd, Austin, TX, 78746, United States of America, agalenko@agileassets.com, Tonya Scheinberg

The lack of resources for economic agents that followed the Great Recession resulted in a substantial increase of asset management literature. Typical topics of that literature are optimization models or optimization algorithms. Surprisingly, the techniques that can be used to reduce model size are not well covered. The authors present a number of ways that can be used to reduce model size while producing near optimal solutions in the context of Pavement Management System

■ TC31

31- North 222 C- CC

Empirical Analysis in Services and Retail

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Antonio Moreno-Garcia, Kellogg School of Management, 2001 Sheridan Road, Evanston, 60208, United States of America, a-morenogarcia@kellogg.northwestern.edu

1 - Override the Revenue Management System? Dynamic Price Rivalry in the Airline Industry

Jun Li, University of Pennsylvania, Wharton School, Philadelphia PA, United State of America, lijun1@wharton.upenn.edu, Serguei Netessine

Most airline revenue management systems in use do not factor in competition. Fare managers may override the system based on how competitors price. Using high-frequent carrier-flight level fare and booking information in selected European routes, we study airline price rivalry. How airlines react to their rivals' price adjustments? We also disentangle the impact of competition and inventory on revenue management controls.

2 - Traffic Arrivals Into Retail Stores - Distributional Assumptions and Why They Matter?

Vidya Mani, Pennsylvania State University, State College, PA, United States of America, vmani@psu.edu, Jayashankar M. Swaminathan, Saravanan Kesavan

We study the distribution of customer arrivals to retail stores in a large retail chain. Most analytical work on customer arrivals assumes a Poisson distribution for planning purposes as it is analytically tractable. Using hourly traffic data from a major retailer, we identify the underlying distribution of incoming traffic and explore the implications of using an incorrect arrival distribution by studying its impact on store labor planning and profitability.

3 - Empirical Analysis of Inventory Display in Retail

Antonio Moreno-Garcia, Kellogg School of Management, 2001 Sheridan Road, Evanston, 60208, United States of America, a-morenogarcia@kellogg.northwestern.edu, Santiago Gallino

Using a combination of observational data and a field experiment, we explore the consequences of inventory display strategies in retail environments across different categories.

4 - Matching Supply with Demand in an Outpatient Clinic

Diwas KC, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, Diwas_Kc@bus.emory.edu, Nikolay Osadchiy

We examine patient scheduling at an outpatient clinic, where a significant number of scheduled appointments end up as no-shows. In this research, we explore factors that lead to the mismatch between demand and supply, and propose potential solutions to help the clinic manage its capacity utilization.

■ TC32

32- North 223- CC

Strategic Operations and Marketing Decisions in a Supply Chain

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Muge Yayla-Kullu, Asst. Prof. Operations Mgmt., RPI Lally School of Mgmt, 110 8th St, Troy, NY, 12180, United States of America, Yayla@rpi.edu

1 - Managing Inventory with Limited History of Intermittent Demand

Alp Akcay, PhD Candidate, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu, Sridhar Tayur, Bahar Biller

Assuming an intermittent demand process with unknown distribution parameters, we study the problem of estimating inventory targets from limited amount of historical demand data. The resulting inventory-target estimates minimize the average expected cost that is attributable to misestimating the optimal inventory target. We also consider the correlation between demand size and the number of inter-demand periods, and propose an integrated estimation-optimization approach to solve the problem.

2 - Entry Deterrence Strategies Facing Capacitated Competition

Huaqing (Mike) Wang, University of Miami, Department of Management, Miami, FL, 33146, United States of America, h.wang12@umiami.edu, Haresh Gurnani, Murat Erkoc

A monopolistic incumbent firm faces entry of a capacity-constrained firm. As function of the entrant's capacity, the incumbent firm can adopt different strategies to try to deter or accommodate the entrant. We also show that when entry is inevitable, the capacitated entrant (incumbent) can get higher profit in Stackelberg competition as follower (leader) than in Nash Competition. We also consider a case in which the incumbent also invests in changing consumers' product preference.

3 - Retailer Buy-back and Supply Chain Performance

Jun Zhang, The University of Texas at Dallas, 800 W. Campbell Rd., Richardson, TX, United States of America, jun.zhang@utdallas.edu, Suresh Sethi, Owen Ma

We study the retailer buy-back program and its impact on supply chain performance. We show that the retailer buy-back program, when properly designed, can improve the performance of all supply chain members.

4 - Global Supply Chain Networks

Nitish Jain, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Nitish.jain@insead.edu, Karan Girotra, Serguei Netessine

We study the evolution of global supply chain networks of publicly traded U.S. retail and wholesale firms. We construct these networks using a novel data-set that is compiled by processing over 10 million import transactions by U.S. firms from global suppliers.

5 - Collaboration Among Supply Chain Partners: Better Outcomes or More Conflict?

Muge Yayla-Kullu, Asst. Prof. Operations Mgmt., RPI Lally School of Mgmt., 110 8th St., Troy, NY, 12180, United States of America, Yayla@rpi.edu

The emerging area of supply chain alliances studies how firms work together for mutual benefit. In this paper, we investigate benefits of such an alliance for collaborative procurement. We take heterogeneity of the customer base into account when the products of firms are differentiated. In such a supply chain network, we find that joint consideration of sourcing, pricing, and demand generation objectives may result in non-trivial outcomes.

■ TC33

33- North 224 A- CC

Inventory Management

Contributed Session

Chair: Xue Lu, PhD Student, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, xlu.phd2009@london.edu

1 - Economic Lot Sizing: The Capacity Reservation Model

Xi Li, HKUST, Clear Water Bay, Kowloon, Hong Kong, Hong Kong-PRC, xitheory@gmail.com, Chung-Yee Lee

Capacity reservation contracts allow a consumer to purchase up to a certain capacity at a unit price lower than that of the spot market, while the consumer's excess orders are realized at the spot price. In this paper, we consider a lot sizing problem where the consumer places orders following a capacity reservation contract. In particular, we study the general problem and the polynomial time solvable special cases of the problem, and propose corresponding algorithms for them.

2 - A Combined Transportation-Inventory Problem for a Multi-Product Probabilistic Demand Environment

Uladzimir Rubasheuski, PhD Scholar, H'gskolen i Molde, Britvegen 2, Molde, 6410, Norway, uladzimir.rubasheuski@himolde.no, Johan Oppen, David L. Woodruff

This paper is devoted to the analysis of the tradeoff between transportation and inventory costs for a multiple products flow on a single link. A linear model has been developed to minimize total costs of transportation and inventory handling by determining the optimal combination of safety factor, replenishment cycle length and delivered quantity for each replenishment.

3 - Optimal Policy and Time Consistency for Multi-stage Inventory Models with Free Distributions

Linwei Xin, PhD. Student, Georgia Tech, 765 Ferst Drive NW, ISyE, Georgia Tech, Atlanta, GA, 30332, United States of America, lwxin@gatech.edu, Alexander Shapiro

In a seminal work on inventory optimization, H. Scarf found an explicit solution to a certain minimax problem with moment constraints and piecewise-linear cost function, when the cost function has only two pieces. In this work, we extend his result to more general cost functions, and discuss several applications in multi-stage inventory models.

4 - The Value of Yield Information in a Periodic Review Inventory System

Marcus Dettenbach, Universtiy of Cologne, Albertus Magnus Platz, Department of Supply Chain Management, Cologne, 50923, Germany, marcus.dettenbach@uni-koeln.de, Ulrich Thonemann

We consider the number of defective units in an order to be random. The information on the number of defective units is available at any time. This setting is compared to a setting in which the yield can only be observed upon arrival of an order. We solve a dynamic program for both settings. To solve larger problems, we develop close-to-optimal heuristics with short run times. We conduct various numerical experiments and identify dependencies for the value of real time yield information.

5 - A Horizon Decomposition Algorithm for the Multi-level Capacity Constrained Lot Sizing Problem

Xue Lu, Phd Student, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, xlu.phd2009@london.edu, Zeger Degraeve

Multi-level capacity constrained lot sizing (MLCLS) has high application value, but solving the problem to optimality remains daunting. We propose a new Horizon Decomposition algorithm for the echelon stock formulation of MLCLS. We decompose the time horizon into contiguous short time horizons. Our algorithm provides a tighter lower bound than all the existing model reformulations, and also CPLEX by 30% within the same computing time.

■ TC34

34- North 224 B- CC

Innovation Contests

Cluster: New Product Development

Invited Session

Chair: Anant Mishra, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, United States of America, amishra6@gmu.edu

1 - Submission Transparency in Idea Generation

Joel Wooten, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States of America, jwooten@wharton.upenn.edu, Karl Ulrich

In innovation tournaments, administrators face a variety of decisions that impact the course of the contest. We examine the effect of submission transparency by comparing blind and unblind contests using innovation tournament field experiments. We control submission visibility and show individual-level differences in idea quality and uniqueness from the tournament participants - the solvers.

2 - Cognitive Response of Workers to Competition

Michael Menietti, Harvard Business School, Boston, MA, United States of America, mmenietti@fas.harvard.edu, Karim Lakhani, Kevin Boudreau, Constance Helfat

Rank-order tournaments are widely employed to incentivize workers and elicit effort. We examine software developers competing in rank-order tournaments. We find performance falls among developers in response to the number of competitors and independently from the presence of superstar competitors. Though those affected still work on solutions, fewer solutions are submitted and more solutions that are submitted contain errors.

3 - Prize Amount and Entry Behavior in Innovation Contests

Anant Mishra, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, United States of America, amishra6@gmu.edu, Cheryl Druehl, Jesse Bockstedt

Innovation contests are being widely used by firms to generate creative ideas and identify solutions to complex problems. Using a large panel dataset of unblind innovation contests from a popular online logo-design platform, we examine the interplay or prize amount and contestant's prior winning experience on their entry behavior in a contest.

4 - The Impact of Monetary and Non-monetary Incentives in Platform-based Innovation Contests

Annika Mueller, Harvard University, Boston, MA, United States of America, amueller@fas.harvard.edu, Karim Lakhani, Kevin Boudreau

In this study we examine the effect of pecuniary and non-pecuniary incentives on the participation, effort and productivity of individuals on an open crowdsourcing contest platform. Specifically, we conduct a unique field-experiment in which subjects are randomly allocated to nine treatment groups to investigate the causal impact of various combinations and levels of money, status and job market signalling as prizes on the participation and performance of coders in an online programming contest.

■ TC35

35- North 225 A- CC

Optimization Models in Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu

1 - Assortment Optimization under General Choice

Srikanth Jagabathula, New York University, Kaufman Management Center, 44 W 4th Street, Rm 8-74 KMC, New York, NY, 10012-1126, United States of America, sjagabat@stern.nyu.edu, Vivek Farias, Devavrat Shah

We consider the classic decision problem of static assortment optimization: find an offer set that maximizes revenue subject to a constraint on its size. We assume access to only revenue estimates for different offer sets. Finding the optimal solution in general requires exhaustive search over offer sets. We propose an approximation algorithm with far fewer calls to revenue function than exhaustive search requires. We also establish theoretical and exhaustive empirical analysis.

2 - Assortment Optimization under Variants of the Nested Logit Choice Model

Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu, Guillermo Gallego, James Davis

We consider assortment optimization problems under several variants of the nested logit model. Under the assumption that the no-purchase is not available in each nest and the so-called nest dissimilarity parameters are between zero and one, we show that we can compute the optimal assortment in polynomial time. The problem is NP-hard when we relax either one of these assumptions. We explore approximation methods for the NP-hard versions of the problem.

3 - Joint Bidding and Pricing Models

Karti Puranam, Assistant Professor, LaSalle University, 1900 Olney Avenue, Philadelphia, PA, United States of America, kartys.here@gmail.com, Michael Katehakis

We present a class of models where a firm procures items by participating in auctions and it decides at what price to sell them. We discuss conditions for the existence of stationary optimal policies of simple structure for the present value and the average-reward optimal policies.

4 - Self-adjusting Price Control for Network Revenue Management

Stefanus Jasin, Assistant Professor, Ross School of Business, University of Michigan, 701 Tappan St., Ann Arbor, MI, United States of America, sjasin@umich.edu

We provide a very simple improvement for the well-known static price control of Gallego and Van Ryzin (1997). Our approach requires only linear updating of target sales rate and does NOT require any re-optimization at all. This suffices to improve the O(T^0.5) regret bound of static control to O(log T). For a certain class of problems, we show how to do semi-decentralized control. Finally, we briefly discuss whether it is possible to update the price of only SOME of the products instead of all.

■ TC36

36- North 225 B- CC

Revenue Optimization and Related MDP Methodologies I

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Michael Katehakis, Department Chair and Professor, Rutgers University, Rutgers Business School, Newark, NJ, 07102, United States of America, mnk@rutgers.edu

1 - Resource Allocation in Stochastic Contests with Exponential Completion Times

Pelin Canbolat, Dr., Technion, Haifa, Israel, canbolat.pg@gmail.com, Uriel Rothblum, Boaz Golany

We study a class of games where players compete to complete a task first by deciding on their resource allocation. Completion times are assumed to be stochastically independent and exponentially distributed with rate linear in the amount of resource allocated. Only the first player to complete the task earns a reward. We explore the mean-variance tradeoffs based on explicit representations of payoff probability distributions, means, and variances for any feasible resource allocation.

2 - Average-Cost Markov Decision Processes with Weakly Continuous Transition Probabilities

Eugene A Feinberg, Professor, Stony Brook University, Stony Brook, NY, United States of America, eugene.feinberg@sunysb.edu, Pavlo Kasyanov, Nina Zadoianchuk

This talk presents broad sufficient conditions for the existence of stationary optimal policies for discounted and average-cost Markov Decision Processes with Borel state and action sets and with weakly continuous transition probabilities. The one-step cost functions may be unbounded, and the action sets may be noncompact. The results allow multiple applications including applications to pricing problems.

3 - Optimal Adaptive Policies for Sequential Allocation Problems – Revisited

Apostolos Burnetas, Professor, University of Athens, Department of Mathematics, Panepistemiopolis, Athens, 15784, Greece, aburnetas@math.uoa.gr, Michael Katehakis

Consider the problem of sequential sampling from a finite number of statistical populations under incomplete information. In a paper in 1996 we showed how to construct index-based policies with uniformly maximum convergence rate for the case in which the distributions of outcomes from each population depend on a vector of unknown parameters. That work is generalized in several directions regarding dependence of observations. Applications in pricing and data mining are presented.

4 - Estimating Willingness-to-Pay and Willingness-to-Sell Distributions from Incomplete Negotiation Data

A. Serdar Simsek, PhD Candidate, Columbia Business School, 3022 Broadway, Uris Hall, 4L, New York, NY, 10027, United States of America, asimsek13@gsb.columbia.edu, Garrett Van Ryzin, Robert Phillips

We develop a method for using the Expectation-Maximization (EM) algorithm to estimate willingness-to-pay (WTP) and willingness-to-sell (WTS) distributions using incomplete negotiation data. The data are incomplete because the final price is recorded only if trade actually takes place and WTP and WTS values are not observed. The results are promising in terms of the accuracy of the computed estimates and when used to predict take-up on both synthetic and real data sets.

5 - Inventory-based Dynamic Pricing with Costly Price Adjustment

Sridhar Seshari, Professor, University of Texas at Austin, McCombs School of Business, Austin, TX, 78712, United States of America, Sridhar.seshadri@mccombs.utexas.edu, Wen Chen, Qi Feng

We study a long-run inventory planning problem in which the retailer can replenish inventory and change price anytime. We establish that it is optimal to change the price from low to high in each replenishment cycle, the optimal order-up-to level may decrease when the ordering cost increases, and fewer customers are served when the unit cost of procurement increases. Additionally, we provide efficient algorithms to compute the stocking and pricing policies.

■ TC37

37- North 226 A- CC

Energy Infrastructure Modeling

Sponsor: Location Analysis

Sponsored Session

Chair: Michael Lim, Assistant Professor, University of Illinois, 1206 S. 6th St., Champaign, IL, 61820, United States of America, mlim@illinois.edu

1 - Competition Among Food, Energy and Environment: Sustainable Biofuel Supply Chain Design

Xin Wang, University of Illinois at Urbana-Champaign, 111 E Healey St Apt 202, Champaign, Il, 61820, United States of America, Wangxin1@illinois.edu, Michael Lim, Yanfeng Ouyang

Some attributes the recent significant raise in food price to rapid expansion of biofuel industry. We propose a continuous biofuel supply chain model to (i) capture the impact of biofuel production on the food market and environment; and (ii) draw managerial insights for the biofuel firms as well as the government.

2 - Renewable Energy Supply Chain Design under Oligopolistic Competition and Uncertainty

Zhaomiao Guo, University of California-Davis, Department Civil & Environment Eng., Davis, CA, 95616, United States of America, zmguo@ucdavis.edu, Yueyue Fan

In this paper, we model the renewable energy supply chain network problem involving oligopolistic firms, who are competing for resources, transmission capacity, and demand market. The decision variables include the production quantities and capacities of energy infrastructures. The non-corporative market behavior is captured by equilibrium conditions. Uncertainties in supply and demand are addressed by stochastic programming techniques.

3 - Facility Location Design for Large Scale Energy Storage Devices

Yong Liang, PhD Candidate, University of California-Berkeley, Etcheverry Hall 1117, Berkeley, CA, United States of America, yongliang@berkeley.edu, Z. Max Shen

Recently there has been growing interest in large-scale electricity storage facilities. In this talk, we construct a model to formulate the problem of selecting locations and sizes of the storage facilities. The objective is to minimize the upfront construction costs plus the long-run operation costs. We also conduct analysis on minimizing the worst cast costs when there are uncertainties associated with the locational marginal pricing and local demands.

4 - Flexible and Convenient Car Sharing System Design and Operations

Guangrui MA, PhD Student, Hong Kong University of Science and Technology, Room 3208, Department of IELM, Clear Water Bay, Kowloon, Hong Kong-PRC, magr@ust.hk, Ho-Yin Mak

Currently, car sharing becomes a popular solution to keep the balance between individual driving and sustainability. But it is criticized for its non-convenience and inflexibility from re-positioning coordination difficulty, which may lower the cars' utilization. The company Car2go announced its car sharing service overcoming these problems. We try to capture the business model, analyze the critical issues, compare with the traditional ways, and show how it influences the whole social warfare.

■ TC38

38- North 226 B- CC

Supply Chain Services: Models and Applications-II

Sponsor: Service Science

Sponsored Session

Chair: M. Ali Ulku, Assistant Professor, School of Management and Leadership, Capital University, 1 College and Main, Columbus, OH, 43209, United States of America, aulku@capital.edu

1 - Incentive Contracts Between 4PLs and 3PLs: An Application of the Principal-agents Model

Qin Zhu, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong SAR, Kowloon, Hong Kong-PRC, qinzhu4@Student.cityu.edu.hk, Y.K., Richard Fung

This paper applies the principal-agent theory to the logistics industry, studying the horizontal cooperation between 4PLs and 3PLs through incentive contracts, where the compensation is a combination of a fixed fee and a bonus based on the performances of the 3PLs, in terms of the service delivery rate and customer satisfaction level.

2 - Managing Risks of Information Asymmetry and Demand Uncertainty in Assembly Supply Chains

Xiang Fang, Assistant Professor, University of Wisconsin-Milwaukee, 3202 N Maryland Avenue, Milwaukee, WI, 53211, United States of America, fangx@uwm.edu, Jun Ru, Yunzeng Wang

We study a decentralized assembly supply chain in which an assembler (she) assembles a set of components, each produced by a different supplier (he), into a final product to satisfy an uncertain market demand. Each supplier holds private cost information to himself, for which the assembler only has a subjetive estimate. The assembler aims to find an optimal menu of contracts in order to maximize her own expected profit and induce each supplier to truthfully reveal his private cost information.

3 - A Decision Support System for Shipment Decisions in a Supply Network with Price Dependent Demands

Asli Sencer, Assoc. Prof., Bogazici University, Hisar Campus, Department of Management, Information Systems, Bebek, Istanbul, 34342, Turkey, asli.sencer@boun.edu.tr, Bertan Badur

In this study a supply network is considered with multiple distributors and retailers. The demands at the retailers are dependent on the selling prices at the destination points. A transportation model with price dependent demands is considered to optimally determine the shipment quantities as well as the prices at the destination points. The model is integrated with a database and user interfaces are developed to form a decision support system (DSS).

4 - Thanks, But No Thanks?: Impact of Donor Behavior on the Humanitarian Logistics Chain

Stephanie Gray Wilson, Assistant Professor, Captial University, Department of Psychology, Columbus, OH, United States of America, swilson@capital.edu, Kathryn M. Bell, M. Ali Ulku

Disaster response requires prompt and efficient organization and delivery of supplies and services in the Humanitarian Logistics Chain (HLC). Solicited and unsolicited donations are frequently provided by various, often uncoordinated, funding sources to assist with disaster relief. This paper explores the impact of different types of funding sources and donations on the HLC and offers a framework of how donor behavior impacts operations. We provide a research outlook for this emerging topic.

■ TC39

39- North 226 C- CC

Topics in Operations Management I

Contributed Session

Chair: Mohamed Ismail, Assistant Professor, University of Regina, 3737 Wascana Parkway, Rgina, SK, S4S0A2, Canada, mohamed.Ismail@uregina.ca

1 - Bus Product Configuration System Based on Mass Customization

Zhiduan Xu, Professor, Xiamen University, Room 606,Building Jiageng 1, 422 Siming South Road, Xiamen, FJ, 361005, China, zhiduanx@xmu.edu.cn

In this paper, a product configuration system is built in order to fulfill different customized orders efficiently and effectively in the Bus industry by creating product families and product platforms. Moreover, the process from the order to the manufacturing is reconstructed based on the system.

2 - A Methodology for Assessing Rework Risks in Projects

Theodore Glickman, Professor of Decision Sciences, George Washington University, 2201 G Street, NW, Duques Hall, Washington, DC, 20052, United States of America, glickman@gwu.edu, Luis Novoa

A methodology for assessing the risks of rework is introduced. A novel approach for representing the rework associated with inspection outcomes as an augmentation of the original activity network is proposed. Risk profiles for project time and cost are developed and displayed in terms of exceedance probabilities.

3 - Lead-time Quotation When Customers are Sensitive to Reputation

Susan Slotnick, Department of Operations and Supply Chain Management, Cleveland State University, 1860 E. 18th Street, Cleveland, OH, 44115, United States of America, s.slotnick@csuohio.edu

This model considers how reputation should influence lead-time optimization. Qualitative monotonicity results are not obtainable, so a computational study explores the relationships between shop status, order size, reputation, market characteristics and the lead-time decision. Regression analysis sheds light on these relationships and suggests three heuristics, which provide near-optimal solutions with relatively short running times.

4 - Progressive Modeling: Towards a New Systems Optimization Paradigm

Mohamed Ismail, Assistant Professor, University of Regina, 3737 Wascana Parkway, Rgina, SK, S4S0A2, Canada, mohamed.Ismail@uregina.ca

Progressive Modeling (PM) is a multidisciplinary forward looking systems optimization approach that finds pragmatic solutions for many complex/large scale industrial problems. PM brings many innovations to problem analytics, modeling, and solution algorithms. This paper introduces many PM principles and demonstrates a handful of PM implementations in different manufacturing environments.

5 - The Multilevel Rationing Policy for Repairable Systems

Pedram Sahba, Research Assistant, University of Toronto, 5 King's College Road, Toronto, ON, Canada, pedram@mie.utoronto.ca, Baris Balcioglu

A repairable system consisting of m manufacturing plants with finite number of machines and a single repair shop is considered in this work. We propose the multilevel rationing policy(MR) for dispatching the spare parts. The MR policy prioritizes classes, and stops serving a class from inventory if the inventory level is below the inventory threshold of that class. We compare the performance of the MR policy with the optimal dynamic policy and the existing dispatching policies in the literature.

■ TC40

40- North 227 A- CC

Joint Session ENRE-Env & Sustainability/Energy: Green Biofuel Supply Chain Management

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability & Energy, Natural Res & the Environment/Energy Sponsored Session

Chair: Yongxi Huang, Assistant Professor, Clemson University, 314 Lowry Hall, Clemson, SC, 29634, United States of America, yxhuang@clemson.edu

1 - An Optimization Model for the Facility Sizing and Location of Thermochemical Biofuel Production

Guiping Hu, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu, Yihua Li

This paper investigates the fast pyrolysis – upgrading – refining pathway, with corn stover being the feedstock and gasoline being the end product. Mixed integer linear programming (MILP) model is formulated to optimize the fast pyrolysis and upgrade facility location and capacity to minimize total production cost. The economic feasibility of building a new bio-refinery in Iowa is analyzed with the comparison to the existing bio-refinery in Louisiana.

2 - Effects of Air Pollutant Emissions Control on the Cost and Spatial Distribution of Biorefineries

Colin Murphy, Graduate Student Researcher, University of California Davis, 2028 Academic Surge, 1 Shields Ave., Davis, CA, 95616, United States of America, cwmurphy@ucdavis.edu, Nathan Parker

UC Davis has developed, a spatially explicit technoeconomic model of large-scale biofuel production in the U.S.Biofuel production may lead to significant air pollutant emissions from agricultural and biorefinery activity. Current research adds costs of additional air pollution control devices to biorefineries in PM and Ozone nonattainment areas, to determine whether the costs of compliance significantly alter the final fuel costs or spatial distribution of biorefineries.

3 - Optimization of Sustainable Biofuel Supply Chain under Uncertainty

Yongxi Huang, Assistant Professor, Clemson University, 314 Lowry Hall, Clemson, SC, 29634, United States of America, yxhuang@clemson.edu, Fei Xie

This study presents a multi-objective stochastic programming approach for cellulosic biofuel supply chain design under uncertainty of conversion technology efficiency. A compromise programming model is formulated to integrate economic competitiveness and environmental quality into system planning and operations. The findings of case study of California show that the technology efficiency can alter the system configurations, however through smart system modeling, the effects can be minimized.

4 - Algorithms for Economic Lot Sizing Models with multi-Mode Replenishments and Carbon Considerations

Gokce Palak, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, gokcepalak@gmail.com, Sandra Eksioglu

We investigate extensions of economic lot sizing models under carbon emission considerations as it applies to the transportation planning decisions. We propose algorithms for these extensions that consider single fixed charge and multiple setups cost structures. Our objective is to show how the changes in the supplier and transportation mode selection choices would contribute to reduction of carbon emissions for alternative carbon regulatory mechanisms.

■ TC41

41- North 227 B- CC

Forestry Session IV

Sponsor: Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State School of Forest Resources, 310 Forest Resources Building, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Construction of Routes on Harvest Areas for Harvesters and Forwarders using Detailed GIS Information

Patrik Flisberg, Norwegian School of Economics, Helleveien 30, Bergen, Norway, pafli@mweb.co.za, Sima Mohtashami, P. Jönsson, Mikael Ronnqvist

Today detailed information on harvest areas including tree locations, terrain condition, altitude and soil conditions can be used to optimize the trail outlay for harvesters and forwarders. We propose a solution method to construct both primary and secondary trails for both machine types. We present results from case studies in Sweden.

2 - Coordination Mechanisms in Forest Value Chains

Sophie D'Amours, Université Laval, Department of Mechanical Engineering, Pavillon Adrien Pouliot, Quebec, QC, G1K 7P4, Canada, sophie.damours@forac.ulaval.ca, Mikael Ronnqvist

Logistic planning is often based on decoupled planning of several independent problems. In these cases, there is a need to introduce coordination mechanisms to find the best solution for the entire chain. We explore a number of planning problems and describe efficient coordination mechanisms based on different decomposition strategies.

3 - Planning under Uncertainty

Patrik Flisberg, Norwegian School of Economics, Helleveien 30, Bergen, Norway, pafli@mweb.co.za, Mikael Frisk, Mikael Ronnqvist

There are many applications in forestry with uncertain data. We explore solution methods and strategies for forest transportation and harvesting when some data is uncertain. Results from case studies are presented.

4 - Routing with Queuing

Bertil Liden, SkogForsk, Uppsala, Sweden, bertil.liden@skogforsk.se, Patrik Flisberg, Mikael Ronnqvist

Routing of trucks is often done with the assumption that routes are independent. This can often lead to extensive queuing at larger mills and it is important to consider this aspect. We propose a solution method which adds on queuing as an important constraint. We present results from case studies in Sweden.

■ TC42

42- North 227 C- CC

Transit System Modeling

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Yueyue Fan, Associate Professor, University of California, Department of Civil & Environmental Eng., Davis, CA, 95616, United States of America, yyfan@ucdavis.edu

1 - Continuum Approximation Model for Transit System Design under Variable Demand

Seyed Mohammad Nourbakhsh, PhD Student, University of Illinois at Urbana-Champaign, B156 Newmark Civil Engineering Laborator, Urbana, IL, 61801-2352, United States of America, nourbak1@illinois.edu, Yanfeng Ouyang

This research proposes a continuum approximation model for transit network design considering variable passenger demand. The model determines the optimal structure of the transit network as well as the bus stop spacing and headway. Numerical experiments illustrate the effective network design for the system under various demand assumptions.

2 - Optimal Operations, Management, and Network Design for Personal Rapid Transit Systems

Ryan Smith, Graduate Research Assistant, University of Illinois at Urbana-Champaign, Newmark Civil Engineering Laboratory, Urbana, Il, 61801-2352, United States of America, smith103@illinois.edu, Yanfeng Ouyang

This paper presents an integrated personal rapid transit planning model that uses a genetic algorithm and an embedded closed queuing network model to optimize the pod fleet size, station location, the number of berths at each station, and the strategy for empty pod reallocation. The model formulates agency investment and user cost as functions of design characteristics.

3 - Optimizing Urban Rail Timetable under Time-dependent Demand and Oversaturated Conditions

Xuesong Zhou, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Huimin Niu

This talk focuses on optimizing a passenger train timetable in a heavily congested urban rail corridor. Based on time-dependent, origin-to-destination trip records from an automatic fare collection system, a nonlinear optimization model is developed to capture the overall passenger delay, subject to the available fleet. Based on cumulative input-output diagrams, several solution algorithms are presented.

■ TC43

43- North 228 A- CC

Unit Train Planning and Scheduling

Sponsor: Railway Applications

Sponsored Session

Chair: Erdem Eskigun, CSX, 500 Water Str, Jacksonville, FL, 32202, United States of America, erdem_eskigun@csx.com

1 - Coal Monthly Reservations Planning

Ece Icyuz, University of Florida, 369 Maguire Village, Apt 4, Gainesville, FL, 32603, eceicyuz@ufl.edu, Jean-Philippe Richard, Erdem Eskigun, Dharma Acharya

Each month, CSX must determine how to best allocate its resources to satisfy the largest possible number of coal reservations. This problem can be formulated as a MIP of gigantic size that cannot be solved with off-the-shelf software. To obtain solutions, we develop a heuristic that produces, in the first phase, an aggregate solution that is later refined in the second phase. We provide some computational results evaluating the speed and quality of solutions using real application data.

2 - Unit Train Generator (UTG) – A Statistical Approach to Forecast Unit Trains

Viraj Karnik, Manager Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309, United States of America, viraj.karnik@nscorp.com, Ilya Lavrik, Tonya Woods

Unit trains form a significant part of Norfolk Southern's transportation business. In this talk we present Unit Train Generator (UTG) – an automated and integrated tool developed by NS Operations Research for transportation planners. UTG, based on monthly unit traffic volume forecast, creates train schedules, i.e. it determines train origin – destination, train route, crew districts, frequency, number of cars, arrival/departure/dwell times.

3 - Freight Railway Operator Timetabling and Engine Routing

Lukas Bach, PhD. Student, Aarhus University, Fuglesangs alle 4, 8000, Aarhus V, Denmark, luba@asb.dk, Michel Gendreau, Sanne W¨hlk

We consider timetable design at a European freight railway operator. This is done by choosing the time of service for demands among discrete points of service within a time-window. The objective in the model is to minimize cost while adhering to constraints regarding infrastructure usage, demand coverage and engine availability. The model is solved by a column generation scheme where feasible engine routings are designed in a label setting algorithm with time-dependent cost and service times.

4 - Unit Train ETA Forecasting

Erdem Eskigun, CSX, 500 Water Str, Jacksonville, FL, 32202, United States of America, erdem_eskigun@csx.com, Dharma Acharya

We present an ETA forecasting tool developed to better estimate the arrival time of CSX unit trains to their destinations. The tool not only considers the standard and historical transit and dwell time data but also the real time delay information to have better forecasts. The delays considered might be due to curfews, derailments, no crew, no engine, and customer shut-downs. ETA forecasts are refreshed at every real time event like arrival, departure, crew call, and delay at route stations.

■ TC44

44- North 228 B- CC

Supply Chain, Practice and Empirics: Inventory

Contributed Session

Chair: Kai Hoberg, Associate Professor of Supply Chain and Operations Strategy, Kühne Logistics University, Brooktorkai 20, Hamburg, Germany, kai.hoberg@the-klu.org

1 - The Effect of Excess Inventory on Operating Performance
Kevin Hendricks, Professor, School of Business & Economics, Wilfrid Laurier University, Waterloo, On, N2L 3C5, Canada, khendricks@wlu.ca, Vinod Singhal

This talk will present empirical evidence on the effect of excess inventory on return on assets, return on sales and sales over assets. The results are based on a sample of nearly 800 publicly traded companies that announce that they have excess inventory. The median decline in ROA ranges from 2.17% to 3.49% over a three-year period around the year of the excess inventory announcement. The median decline in ROS (SOA) ranges from 1.58% to 2.77% (6.13% to 6.91%).

2 - Industrial Vending and VMI: Usage, Challenges, and Successes
John Kros, Professor of Marketing and Supply Chain Management, East Carolina University, 3205 Harold Bate, Greenville, NC, 27858, United States of America, krosj@ecu.edu

Almost everyone has used a vending machine at some point in time to get a soda or snack. Vending machines aren't confined to just the cafeteria. Industrial vending machines provide solutions to many different Supply Chain challenges. This research is to help gain a better understanding of increased efficiency & cost saving opportunities offered by industrial vending machines & vendor managed inventory (VMI). Questions as "Who are the players? What are the costs & benefits?" are addressed.

3 - Inventory Management under Financial Distress: An Empirical Analysis
Kai Hoberg, Associate Professor of Supply Chain and Operations Strategy, Kühne Logistics University, Brooktorkai 20, Hamburg, Germany, kai.hoberg@the-klu.org, Mario Pesch

Financial distress is a threat to the survival of many firms. Manufacturers typically have high amounts of capital tied up in inventories that could be transformed to cash in distressed situations. We leverage empirical data for 5,489 US firms in the 1994-2007 period to identify their actions under financial distress. We find evidence that a sample of 198 distressed manufacturers significantly reduce their inventory by an average 9.4% to ensure liquidity.

4 - Improving Agility of Forest Supply Chain through Adding Flexibility in the Wood Procurement Phase
Shuva Gautam, Université Laval, Département des Sciences du Bois et de la Forêt, Faculté de Foresterie, de Géographie et de Géomatique, 2405, Rue de la Terrasse, Pavillon Abitibi-Price, Quebec, QC, G1W2L7, Canada, shuva-hari.gautam.1@ulaval.ca, Daniel Beaudoin, Luc LeBel

Wood procurement planning models for the forest supply chain accept predefined silvicultural decisions made at an upper hierarchical level. Flexibility in such decisions at the operational level where demand data is more accurate should improve the supply chain agility. However, making silvicultural decisions at the operational level requires the planners to anticipate and ensure long-term sustainability of their decision. We propose a mixed integer programming model to addresses these issues.

■ TC45

45- North 229 A- CC

Panel Discussion on Women in Engineering: Publishing, Recruitment, and Retention

Sponsor: Women in OR/MS

Sponsored Session

Chair: Laura McLay, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

1 - Panel Discussion on Women in Engineering: Publishing, Recruitment, and Retention
Moderator: Laura McLay, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave., Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Panelists: Mary Anderson-Rowland, Robyn McKay

The panelists will discuss issues for women in OR/MS as they relate to publishing, recruitment, and retention of women. The panelists are listed as co-authors in this talk.

■ TC46

46- North 229 B- CC

Game Theory II

Contributed Session

Chair: Aadhaar Chaturvedi, Assistant Professor, University of Namur (FUNDP), Rempart de la Vierge 8, Bureau 406, B-5000, Namur, Belgium, aadhaar.chaturvedi@fundp.ac.be

1 - Beyond the Nash Equilibrium
Bill Corley, Professor, UT-Arlington, Box 19017, Arlington, TX, 76019, United States of America, corley@uta.edu

The Nash, or Regret, Equilibrium remains the standard solution concept for n-person game theory. Two alternative approaches are presented. The Disappointment Equilibrium (DE) is first defined as a solution where a mutual standoff forces cooperation yielding better outcomes for all players in many situations. The Compromise Equilibrium (CE) is next defined by a scalarization. It gives solutions similar to the DE, but a CE is Pareto optimal as well as computationally tractable for $n > 2$.

2 - Computing Pure Strategy Equilibria of a Finite n-Person Game
Ping Zhao, PhD Student, City University of Hong Kong, SEEM, Kowloon, Hong Kong-PRC, loisgemini@gmail.com, Chuangyin Dang

It is well known that determining whether a finite n-person game has a pure strategy equilibrium is an NP-hard problem. To tackle this problem, we propose a convex nonlinear 0-1 integer programming approach. Numerical results show that the approach is promising.

3 - On Traveling Salesman Games with Asymmetric Costs
Nelson Uhan, Assistant Professor, United States Naval Academy, Mathematics Department, Chauvenet Hall, Annapolis, MD, 21402, United States of America, uhan@usna.edu, Alejandro Toriello

We consider cooperative traveling salesman games with non-negative asymmetric costs satisfying the triangle inequality. Using a variant of the Held-Karp relaxation and its dual, we construct a stable cost allocation with budget balance guarantee equal to the Held-Karp integrality gap for the asymmetric traveling salesman problem. Our results extend similar work for traveling salesman games with symmetric costs.

4 - Testing Bidding Equilibrium with Capacity Constrained Auctions
Aadhaar Chaturvedi, Assistant Professor, University of Namur (FUNDP), Rempart de la Vierge 8, Bureau 406, B-5000, Namur, Belgium, aadhaar.chaturvedi@fundp.ac.be, Constantin Blome

In this paper we formulate the equilibrium bidding strategies in a first price sealed bid procurement auction when the suppliers (bidders) are capacity constrained. We then conduct sensitivity analysis of the equilibrium bid with respect to the capacity of the bidder, the competing supplier and the reserve price announced by the buyer. Finally, we experimentally test our theoretical predictions through controlled laboratory experiments.

■ TC47

47- North 230- CC

Dynamic Traffic Assignment III - User Equilibrium Modeling in Continuous-Time

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Jeff Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St, JEC 4034, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu

1 - Lagrangian-based Hydrodynamic Model: Highway Traffic Estimation
Tao Yao, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, taoyao@psu.edu, Ke Han, Terry Friesz

The widely studied Lighthill-Whitham-Richards model is formulated in Eulerian coordinate system. We formulate the LWR model in the Lagrangian coordinates and propose a numerical algorithm for solving the PDE with multiple value conditions. This is applied to highway mobile sensing, data fusing and traffic estimation.

2 - Approximating Time Delays in Solving Continuous-time Dynamic User Equilibrium
Rui Ma, Rensselaer Polytechnic Institute, Troy, NY, United States of America, mar2@rpi.edu, Jeff Ban, Jong-Shi Pang

An analytic dynamic user equilibrium formulation usually contains time delayed terms to capture realistic traffic dynamics, such as flow propagation. Such delay is often time-varying and state-dependent. In this talk, we propose some schemes to approximate such complicated delayed terms with constant delayed terms which are easier to deal with mathematically. Numerical results are provided to illustrate the proposed approximation method.

3 - Continuous-time Dynamic User Equilibrium Models with Capacitated Point Queues
Jeff Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St., JEC 4034, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu, Rui Ma, Jong-Shi Pang

We propose a differential variational inequality (DVI) formulation for the continuous-time dynamic user equilibrium problem. The formulation integrates the double queue model for capturing more realistic queue dynamics.

4 - Reconstructing the Path-delay Operator for the Continuous Time Dynamic User Equilibrium Problem
Eric Richardson, Rensselaer Polytechnic Institute, Troy, NY, United States of America, richae3@rpi.edu, Jeff Ban

In this paper we consider the path-based infinite dimensional variational inequality formulation of dynamic user equilibrium put forward by Friesz et al 1993 and the link-node based dynamic complementarity system formulation by Ban et al 2011. We show that by properly defining the entry flow function put forth by Friesz et al 1993, we can reformulate the infinite dimensional variational inequality put forward by Friesz et al 1993 into a dynamic complementarity system of the form used by Ban et al 2011. Using this result, we show that the path-delay operator proposed by Friesz et al 1993 can be reconstructed analytically from the link-queue dynamics of Ban et al 2011 providing a continuous time, analytical formulation of the path-delay operator.

■ TC48

48- North 231 A- CC

Facility Logistics II

Sponsor: Transportation Science & Logistics/ Facility Logistics

Sponsored Session

Chair: Sunderesh Heragu, Professor, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, s.heragu@louisville.edu

1 - Optimal Work Release Policies for Order Fulfillment Operations
Kevin Gue, Auburn University, Industrial & Systems Engineering, Auburn, AL, United States of America, kevin.gue@auburn.edu, Erdem Ceven

Order fulfillment firms frequently offer service promises of the sort, "Order by this time, and get your shipment the next day." How do they determine "this time?" We show how to determine release times for waves in an order fulfillment center to allow "this time" to be as late as possible, thus providing the best service to customers and the greatest competitive advantage to the firm. We illustrate the method with data from a large distributor in the Northeast.

2 - Pareto Optimal Solutions for a Double Row Layout Problem
Chase Murray, Assistant Professor, Industrial & Systems Engineering, Auburn University, Auburn, AL, United States of America, ccm0022@auburn.edu, Xingquan Zuo, Alice E. Smith

We consider a facility layout problem where rectangular machines of unequal size are placed on either side of an aisle. Objectives include minimizing the total material flow cost and minimizing the facility area, with the added restriction that each pair of machines must observe a minimum required clearance. Only problems of very small size may be solved optimally via commercial integer programming solvers. Therefore, a new approach to estimating the Pareto front is proposed.

3 - An Optimal Resource Allocation Model Aging for Bus Transit Fleet Based on Service Life and Budget Constraint
Sushant Sharma, Purdue University, NEXTRANS, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu, Sabyasachee Mishra

An optimization model for allocation of funds among different fleet improvement programs within budget constraints over the planning period is presented. This is achieved by minimizing the Net Present Cost of the investment within the constraint of remaining life of the fleet. The model formulation and application are demonstrated with a real world case study of transit agencies.

4 - An Optquest Optimization of a Defense Logistics Warehouse
Sunderesh Heragu, Professor, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, s.heragu@louisville.edu, Banu Ekren

In this study, we propose a near optimum design for the receiving area of the largest warehouse of The Defense Logistics Agency located in New Cumberland, PA. We develop a simulation based optimization model using OptQuest in ARENA 13.9 software. In the optimization model, we aim to optimize the number of workers required in the induction stations. The performance measure of the system is considered as the average cycle time of a material type having high priority in process.

■ TC49

49- North 231 B- CC

City Logistics Impact Evaluations

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Erica Wygonik, University of Washington, Box 352700/ More Hall, Civil & Environmental Engineering, Seattle, WA, 98195, United States of America, ewygonik@uw.edu

1 - Economic Impact Analysis of City Logistics Alternatives using the Southern California Planning Mode
Qian An, PhD Candidate, University of Southern California, Los Angeles, CA, 90007, United States of America, qan@usc.edu, James Moore, Maged Dessouky

Two-level city logistics distribution system has the potential to reduce distribution cost, but the most importantly benefit is the improvement of traffic conditions and other aspects of urban life impacted by the indirect cost of vehicles, such as environmental quality and safety. We apply the Southern California Planning Model, which is a spatial input-output model of the urban economy, to measure regional economic impacts in, but not limited to, the five-county Los Angeles region.

2 - How Carbon Pricing Affects the Efficiency of Urban Delivery Cooperation?
Qin Chen, University of Illinois-Chicago, 847 W Taylor St., MC246, Chicago, IL, 60607, United States of America, qchen23@uic.edu, Jane Lin

We analyze the impact of carbon pricing on urban delivery cooperation by comparing the cost of delivery with/without cooperation. A combination of logistics cost and carbon emission cost is considered in the objective. MOVES model is used to capture the transportation emissions in the logistics activities. The delivery problem is formulated at the tactical level with Continuous Approximation method, which approximates the discrete data with continuous function in a closed form solution.

3 - Commercial Vehicles Fleet Replacement Optimization: Electric Trucks vs Conventional Diesel Trucks
Miguel Figliozzi, Associate Professor, Portland State University, P.O. Box 751 CEE, OR 97207-075, Portland, OR, United States of America, figliozzi@pdx.edu, Wei Feng

This research presents a vehicle fleet replacement model that aims at minimizing fleet total net cost in a planning time horizon, including purchase cost, energy cost, operating and maintenance cost, emissions cost and salvage revenue. A set of economic and technological factors, as well as fleet initial configuration are incorporated into the model, and their impacts on the competitiveness between electric trucks and conventional trucks are analyzed.

4 - Developing Heuristics for the VRP to Address Emissions, Time Windows, and Fleet Heterogeneity
Erica Wygonik, University of Washington, Box 352700/ More Hall, Civil & Environmental Engineering, Seattle, WA, 98195, United States of America, ewygonik@uw.edu, Felipe Sandoval, Anne Goodchild

This work extends existing heuristics to accommodate the additional complexity of emissions, time windows, and fleet heterogeneity on solutions to the Vehicle Routing Problem. The model is tested and refined using real-world case studies to evaluate the influence of the differing constraints on the solutions. Each case study is unique with differing vehicle heterogeneity, network connectedness, and load characteristics.

■ TC50

50- North 231 C- CC

Modeling and Analyzing Military Operations and Systems II

Sponsor: Military Applications

Sponsored Session

Chair: Amnon Gonen, Dean, Faculty of Management of Technology, HIT - Holon Institute oof Technology, 52 Golomb St., Holon, 58102, Israel

1 - Military Reality Modeling and Approximation

Amnon Gonen, Holon Institute of Technology, HIT, Golomb 52, Holon, Israel, agonen@hit.ac.il

Some of the military models are so complicated that users can hardly estimate the magnitude of results. The paper discusses approximation techniques to hit and kill probably. In some cases the physical model of human behavior is approximated by an "inverse engineering" approach that will be shown by the suppression modeling. In this case, the modeling starts from the results toward their cause and formulate the calculation process that fits these final results.

2 - Mathematical Modeling for Decision Making

William Fox, Naval Postgraduate School, Monterey, CA, 93943, United States of America, wpfox@nps.edu

Building models to inform decision makers about alternative choices is critical in today's rapidly changing world. In this presentation we examine several scenarios and illustarte how mathematical modeling can be used as a decision tool to assist the decision maker.

3 - Soldier Narrative Analysis as Part of a Rapid Fielding Process

Michael Jaye, Associate Professor, Department of Defense Analysis, 1 University Way, Monterey, CA, 93943, United States of America, mjjaye@nps.edu, Patrick Driscoll

The warfighter Technology Tradespace Methodolgy employs technology acceptance theories and applies them to TSOA activities, which focus on working with developers to gather system data relative to warfighter expectations and concerns. Collecting and analyzing narratives from soldier end users can inform that process. The accumulation and tagging of multiple sense-making items provide sophisticated metadata which can be used to provide quantitative research material, as well as impact analysis.

■ TC51

51- North 232 A- CC

Big Data Analytics for Condition Based Maintenance

Sponsor: Military Applications

Sponsored Session

Chair: Dan Widdis, Fellow, Principal Operations Research Analyst, Concurrent Technologies Corporation, 5897 Castleberry Peak Ave., Las Vegas, NV, 89131, United States of America, widdisd@ctc.com

1 - Using Large Data Analytics and Prognostics Simulation for Performance-Based Investment Decisions

Norm Reitter, Advisor, Information Technology, Concurrent Technologies Corporation, 329, 44th Street, Pittsburgh, PA, 15201, United States of America, reittern@ctc.com

Investments in Army CBM aviation health monitoring devices to collect sensor data provide an opportunity to reduce supply chain costs through improved prognostic capabilities. Gleaning useful prediction capability from these very large data sets requires robust experimentation and simulation to sufficiently test the benefits of these investments. We use predictive algorithms to determine a combined risk of stock out and simulation methods to determine expected supply chain performance.

2 - A Big Data CBM Solution using Embedded Analytics

Natarajan Sridhar, Advisor Information Architect, CTC, 100 CTC Drive, Johnstown, PA, 15963, United States of America, nataraja@ctc.com

There are multiple challenges associated with implementing embedded analytics in big data CBM environments to support decisions across multiple maintenance/supply echelons (Unit to Enterprise):(a) managing "big" source data;(b) provisioning focused analytic datasets; and(c) providing timely/effective decision support information. We present a solution that combines systems engineering and analytics best practices to support unit-level decision support for Army Aviation platforms.

3 - Semantic Reasoning Over Big Data for Condition Based Maintenance and Mission Based Forecasting

Wes Regian, Principal Knowledge Engineer, Concurrent Technologies Corporation, 15091 Alabama Highway 20, Suite A, Madison, AL, 35756, United States of America, regianj@ctc.com

CBM as practiced today ignores impending mission characteristics. Brigade Aviation Maintenance Officers (BAMOs) on the other hand, predict parts needs for upcoming mission characteristics based on failures observed in the past under similar mission conditions. Semantic analysis offers the possibility of machine reasoning to combine knowledge of MBF with CBM – supporting BAMO-like machine reasoning in combination with CBM capabilities.

■ TC52

52- North 232 B- CC

Decision Making for Electric Vehicles

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Timothy Sweda, PhD Candidate, Northwestern University, 2145 Sheridan Rd., Rm. C210, Evanston, IL, 60208, United States of America, tsweda@u.northwestern.edu

1 - A Robust Dynamic Algorithm to Provide Grid Services with a Fleet of Plug-In Electric Vehicles

Nicole Taheri, Stanford University, 344 Olmsted Road, #449, Stanford, CA, 94305, United States of America, ntaheri@stanford.edu, Robert Entriken, Yinyu Ye

Plug-in electric vehicles (PEVs) may be capable of discharging and flexible charging options. We construct an algorithm for a fleet of PEVs that efficiently organizes distributed electricity trading to benefit consumers and utilities. A robust linear programming model of the fleet can be used by an aggregator to allocate energy exchange schedules to vehicles instantly as they plug-in. The resulting schedules are robust to uncertain driving behavior. We give empirical results using real data.

2 - Approximate Dynamic Programming for Battery Purchase and Charging at Swap Stations

Frank Schneider, PhD Candidate, University of Cologne, Albertus-Magnus-Platz, Department for SCM & Mgmt. Science, Cologne, 50923, Germany, frank.schneider@uni-koeln.de, Diego Klabjan

We formulate and solve the decision problem of the number of batteries to have in circulation at a battery swapping stations. This also entails the decision making about how many batteries to start charging in each time period. Demand for battery swapping and prices of electricity are stochastic. We propose an algorithm combining classical optimization and approximate dynamic programming. We also provide a numerical study.

3 - Optimal Routes for Electric Vehicles Facing Uncertainty, Congestion, and Energy Constraints

Matthew Fontana, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, mfontana@mit.edu, Daniel Reich, Oleg Gusikhin, Perry MacNeille, Dimitris Bertsimas, Erica Klampfl, Thomas Magnanti, Ryan McGee

To address range anxiety for drivers of battery electric vehicles, we propose a robust optimization model to find optimal routes under uncertainty and congestion while considering constraints on total energy. We describe the physics of electric vehicles, the overall model, and our solution approach. We have implemented our approach using data from a Geographic Information System with very promising results.

4 - Optimal Routing and Recharging Algorithms for Electric Vehicles

Timothy Sweda, PhD Candidate, Northwestern University, 2145 Sheridan Rd., Rm. C210, Evanston, IL, 60208, United States of America, tsweda@u.northwestern.edu, Diego Klabjan, Irina Dolinskaya

Recharging decisions for electric vehicles (EVs) are complex for a number of reasons. The time required to recharge can be significant compared to the total trip time, and the charge rate at a given charging station depends on the station's voltage and the vehicle's charge level. In addition, battery health must be preserved. We model the problem of coordinating routing and recharging decisions for EVs as a dynamic program and present several solution algorithms and their analyses.

■ TC53

53- North 232 C- CC

Pricing in Electricity Markets Including Nonconvexities and Stochastic Producers

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Antonio Conejo, Professor, Universidad Castilla - La Mancha, Campus Universitario, Ciudad Real, 13071, Spain, Antonio.Conejo@uclm.es

1 - A Single Settlement Energy only Market to Harness Wind Generation

Golbon Zakeri, University of Auckland, 70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz, Geoff Pritchard, Andy Philpott

We discuss a stochastic-programming-based method for scheduling electric power generation subject to uncertainty. Such uncertainty may arise from either imperfect forecasting or moment-to-moment fluctuations, and on either the supply or the demand side. The method gives a system of locational marginal prices which reflect the uncertainty, and these may be used in a market settlement scheme in which payment is for energy only. We show that this scheme is revenue-adequate in expectation.

2 - Pricing Electricity in Pools with Stochastic Producers

Juan Miguel Morales, Technical University of Denmark, Kongens Lyngby, Denmark, jmmgo@imm.dtu.dk, Antonio Conejo

As the presence of stochastic producers in a power system increases, balancing costs may become highly dependent on the day-ahead market outcomes. We present a clearing algorithm for a day-ahead electricity market that co-optimizes the forward dispatch and the projected balancing actions by using a two-stage stochastic programming approach. A set of electricity prices that consistently supports the forward positions acquired by market agents under this form of market clearing is investigated.

3 - Pricing Non-convexities in an Electricity Pool

Carlos Ruiz, École Centrale Paris and Supelec, Grande Voie des Vignes, Châtenay-Malabry, 92295, France, carlosruizmora@gmail.com, Antonio Conejo, Steven Gabriel

Electricity pools are generally cleared through auctions formulated as non-convex MILP problems that make difficult the derivation of adequate marginal prices. In this work we propose a primal-dual approach to derive efficient revenue adequate uniform prices that guarantee that dispatched producers are willing to remain in the market. Such prices may not significantly deviate from the marginal prices obtained if integrality conditions are relaxed in the original MILP problem.

■ TC54

54- Regency Ballroom A- Hyatt

Learning in Social Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Ilan Lobel, New York University, Stern Business, 44 W 4th St, New York, NY, United States of America, ilobel@stern.nyu.edu

1 - Observational Learning with Finite Memory

Kimon Drakopoulos, Massachusetts Institute of Technology, 32 Vassar St., Cambridge, MA, 02139, United States of America, kimondr@mit.edu, John N. Tsitsiklis, Asuman Ozdaglar

We consider a sequence of agents making decisions regarding the unknown value of the underlying state of the world after receiving private information and observing the decisions of their K immediate predecessors. We study conditions on the communication and information structure under which agents' decisions converge to the correct value of the underlying state. Finally , we analyze the learning behavior of the equilibria that arise from a sequential game between forward looking agents.

2 - Bayesian Social Learning with Consumer Reviews

Bar Ifrach, Columbia Business School, 3022 Broadway, Uris Hall, 4 West, New York, NY, 10027, United States of America, BIfrach14@gsb.columbia.edu, Marco Scarsini, Costis Maglaras

We study a market with heterogeneous customers who rationally learn the quality of an offered product by observing the reviews of customers who purchased the product earlier in time. We explore aspects of this social learning process such as: its success in revealing the true quality over time, and the effect of the order in which reviews are submitted on consumers' beliefs. In addition, we draw conclusions on the seller's pricing problem when accounting for social learning.

3 - Social Learning with Network Uncertainty

Evan Sadler, New York University, Stern Business, New York, NY, United States of America, esadler@stern.nyu.edu, Ilan Lobel

We construct a sequential model of social learning in complex networks and examine the perfect Bayesian equilibria of this model. In contrast to prior models in which the neighborhoods of agents are independent of each other, we consider arbitrary network topologies and show that prior characterizations of conditions under which learning occurs fail. We give new characterizations that offer insights on new phenomena that can occur in complex networks.

4 - A Bayesian Approach for Predicting the Popularity of Tweets

Tauhid Zaman, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA, United States of America, zlisto@mit.edu, Emily Fox, Eric Bradlow

We present a Bayesian approach for predicting the popularity of "tweets" from the micro-blogging site Twitter. Our approach predicts how many people will interact with a tweet, along with how quickly its popularity will rise using only observations of when users interact with the tweet and their basic social network information. We find our method can produce relatively accurate predictions even when observing only a small number of interactions.

■ TC55

55- Regency Ballroom B - Hyatt

Undergraduate Operations Research Prize II

Cluster: Undergraduate Operations Research Prize

Invited Session

Chair: Feryal Erhun, Stanford University, Stanford, CA, United States of America, ferhun@stanford.edu

1 - A Cost-minimizing Heuristic Solution Algorithm for the Network Sensor Location Problem

Emanuel Seitinger, Vienna University of Economics and Business, Vienna, Austria, emanuelseitinger@aon.at

The cost-effective and accurate estimation of traffic flows is of immense importance in traffic planning. We discuss one exact and one heuristic solution procedure for the network sensor location problem. While the exact solution procedure turns out to be unfeasible for many real-life applications, its modification that takes costs, assumptions on human behavior and turning proportions into account comes up with greatly improved results.

2 - A Heuristics for Radio Station Location for Telecommunications in Rural Areas

José Ignacio del Villar, Instituto Tecnológico Autónomo de México, Mexico City, Mexico, David Fernando Muñoz

We discuss the problem of finding a minimum cost location of Long-Haul equipment for wireless telecommunications in rural areas. We show that this problem has an Integer Linear Programming formulation. We developed and tested a heuristics based in the ideas of the Minimum Spanning Tree. Our experiments show that the solution provided by this heuristics may be used as a good initial solution when developing an exact algorithm or a search algorithm specially designed for this problem.

3 - Network Theoretic Characterization of Corporate Structures

Hao Fu, Vassar College, 124 Raymond Avenue, Box 2555, Poughkeepsie, NY, 12604, United States of America, markfu1022@gmail.com

It is unclear whether traditionally hierarchal corporate structure meets today's demand for innovation. This research provides a framework for comparing different corporate structures using network theoretic characterizations. Some prevalent social networks are examined and compared to hierarchical structure both analytically and numerically. The result shows structures resembling social networks had more advantage in innovation. A general algorithm is provided to design desirable structures.

4 - An Access Network Design Problem With Nonlinear Qos Constraints

Chanwoo Park, Korea University, Anamdong 5 Ga, Sungbuk Gu, Seoul, Korea, Republic of, st2v@korea.ac.kr

We present an access network design problem with nonlinear QoS constraints. The problem can be conceptualized as a two-level hierarchical location-allocation problem on the tree topology. By exploiting the special structure of the nonlinear QoS constraints, we devise an exact optimal algorithm with an effective constraint generation strategy. We present promising computational results that demonstrate the effectiveness of the proposed solution procedure.

■ TC56

56- Curtis A- Hyatt

Emerging Themes in Technology Management

Sponsor: Technology Management

Sponsored Session

Chair: Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu

1 - A Model of Product Specification Decision-making and Project Failure

Zhijian Cui, Assistant Professor of Operations Management, IE Business School, Calle de Maria de Molina, 12, Madrid, 28006, Spain, Zhijian.Cui@ie.edu, Christoph Loch

This study models the bargaining process between two parties (leader and follower) on a one-dimensional feature design decision for a new product. We examine three managerial levers to reduce the risk of bargaining failure. First, follwer can reduce the failure risk by signaling his fallback. Second, giving leader an incentive (as with a bonus) exacerbates the risk of failure. Third, if follower cares about his relative payooff or status, this also increases the risk of failure.

2 - New Wine in Old Bottles? Print-newspapers' Overlooked Role in Digital Media Diffusion

Bo Kyung Kim, Assistant Professor, Southern Methodist University, Cox School of Business, 6212 Bishop Boulevard 323 Fincher, Dallas, TX, 75205-0006, United States of America, kimb@smu.edu

During the implementation process of discontinuous technology, incumbents can emphasize the similarity between new and current technologies to have better adoption performance by making their current assets more valuable in the new market. In the U.S. daily newspaper industry, incumbent newspapers that deemphasized interactivity on the web, the most distinctive character of digital media from print media, indeed had better online readership, potentially creating "print-media-like" digital media.

3 - How Can Companies Leverage Their External Environment when Engaging in Open Innovation?

Irina Savitskaya, Post-Doctoral Researcher, Lappeenranta University of Technology, Skinnarilankatu 34, Lappeenranta, 53850, Finland, Irina.Savitskaya@lut.fi

In the modern environment firms do not operate by themselves, they are rather a part of ecosystems. Hence their actions and success depends on how good are they in co-innovation. When companies engage in open innovation activities, they most commonly build a strategy on cooperation with the direct stakeholders. What often stays neglected is the role of external factors influencing and shaping this cooperation: structural, institutional and cultural environment play an important role.

4 - Paradigm-changing vs. Paradigm-deepening Innovation: Firm Scope and Technological Response to Shocks

Vivek Tandon, Assistant Professor, National University of Singapore, 15 Kent Ridge Drive, Singapore, Singapore, vtandon@nus.edu.sg, Gautam Ahuja, Curba Lampert

We examine firms' technological response to supply shocks (sharp increase in a key input's price). Firms can respond by investing in paradigm-changing technologies that use substitute inputs or in paradigm-deepening ones that improves the efficient use of existing inputs. Our framework relates this choice with the degree of relatedness across a firm's businesses. We test our hypotheses examining the responses of large manufacturing firms in the United States to the oil shock of the early 1980s.

■ TC57

57- Curtis B- Hyatt

Applied Probability in Energy and Risk Analysis

Sponsor: Applied Probability

Sponsored Session

Chair: Jose Blanchet, Columbia University, 500W 120th St, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Searching for Optimal Control Algorithms for a Power Grid System using Efficient Simulation Methods

Juan Li, Columbia University, IEOR Department, 500 West 120th Street, New York, NY, 10027, United States of America, jl3035@columbia.edu, Jose Blanchet, Daniel Bienstock

Considering a power grid system with random wind power and stochastic line outages, we study the optimal control in the rare event of a cascading failure using efficient simulation methods. We implement our optimal control algorithms into real-world examples. Numerical results are provided.

2 - Networking Low-power Energy Harvesting Devices: Measurements and Algorithms

Aya Wallwater, Columbia University, Rm. 325 Mudd Building, 500 W. 120 Street, New York, NY, 10027, United States of America, aw2589@columbia.edu, Gil Zussman, Maria Gorlatova

Recent advances in energy harvesting will soon enable networks composed of energy harvesting devices.These devices will operate using very low energy.We characterize the light energy available in indoor environments and present new algorithms, which requires non-traditional approaches, since energy harvesting shifts the nature of energy-aware protocols from minimizing energy expenditure to optimizing it. We develop algorithms for systems with predictable energy inputs, as well as stochastic.

3 - A Stochastic Model for Risk Management

Xinyun Chen, Columbia University, 500 West 120th Street, 323 Mudd Building, New York, NY, 10027, United States of America, xc2177@columbia.edu, Jose Blanchet

We develop a bottom-up model for risk analysis of a family of financial systems. The model is able to capture the changes in the macro-environment and the dependence among individuals in the system. We also show some convergence results of the related stochastic processes and as a direct consequence, many quantities of interest, such as the default probability, can be estimated from the model parameters.

■ TC58

58- Phoenix East- Hyatt

Healthcare Operations

Sponsor: Applied Probability

Sponsored Session

Chair: Nikos Trichakis, Assistant Professor, Harvard Business School, Boston, MA, United States of America, ntrichakis@hbs.edu

Co-Chair: Ross Anderson, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02142, United States of America, rma350@mit.edu

1 - Efficiency of Joint-ventures in the Healthcare Industry

Retsef Levi, Massachusetts Institute of Technology, 100 Main Street, Building E62-562, Cambridge, MA, United States of America, retsef@mit.edu, Georgia Perakis, Cong Shi, Wei Sun

Motivated by the growing popularity of joint ventures among healthcare providers, we consider a setting with demand uncertainty and compare the joint venture profit with nonlinear convex costs in a Nash equilibrium to a system optimum which maximizes the collective benefit. We develop a parametric bound on the efficiency of joint ventures. We show that the efficiency depends on the marginal cost to revenue ratio as well as the spread of the demand distribution.

2 - A Dynamic Model of Kidney Exchange Programs

Ross Anderson, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02142, United States of America, rma350@mit.edu, Itai Ashlagi, David Gamarnik

Kidney exchanges enable incompatible donor-patient pairs to trade donors with other incompatible pairs. In practice, kidney exchanges periodically compute a set of trades to maximize the number of transplants. However, these policies do not consider long term objectives. For a dynamic model, we show that if trades are assigned too frequently, then the average waiting time for a transplant actually increases. We corroborate this result with historical data from a large kidney exchange.

3 - Multi-hospital Kidney Exchange: Dynamic Matching in a Heterogenous System

Vahideh Manshadi, Postdoc, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-113, Cambridge, MA, 02139, United States of America, manshadi@mit.edu, Patrick Jaillet, Itai Ashlagi

Matching algorithms are major tools for kidney exchange programs and different programs use different algorithms. A major unresolved concern is the tradeoff between waiting time and number of matches. In this work we begin to develop mechanisms for kidney exchange in large kidney exchange programs in a dynamic setting. Our goal is to devise allocation rules for which the average waiting time of pairs is small and at the same time, the total number of exchanges is large.

■ TC59

59- Phoenix West- Hyatt

Optimal Control Policies II

Sponsor: Applied Probability

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, ME 3258, Madison, WI, United States of America, ananth@engr.wisc.edu

1 - Optimal Control of an Intersection

Erjen Lefeber, Technische Universiteit Eindhoven, Eindhoven, 5600MB, Netherlands, A.A.J.Lefeber@tue.nl, Dirk van Zwieten

In this paper we present a method to determine an optimal periodic orbit for a fluid model describing an intersection of urban traffic. We first determine the set of feasible modes (clique problem), subsequently the possible sets of modes to use during a cycle, then the sequence of modes (traveling salesman problem), and finally the duration of each mode (quadratic program). We apply this method to a crowded intersection in the city of Eindhoven.

2 - Optimal Harvesting Policies to Control Batch-to-batch Variability in Bioreactors

Tugce Martagan, University of Wisconsin-Madison, 1550 Engineering Drive, Engineering Cent, Madison, WI, 53706, United States of America, martagan@wisc.edu

Controlling batch-to-batch variability presents a significant challenge in biomanufacturing processes. In this paper, we model upstream biomanufacturing operations using Markov Decision Process model, and identify optimum harvesting policies to minimize expected cost in the presence of batch-to-batch variability. We subsequently assess the robustness of these policies to manufacturing uncertainties.

3 - Optimal Control of a Two-server Queueing System with Breakdowns

Jeffrey Kharoufeh, Associate Professor, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, jkharouf@pitt.edu, Erhun Ozkan

We consider controlling a two-server Markovian queueing system with heterogeneous servers, at least one of which is unreliable. Our objective is to dynamically route customers at arrival, failure, and repair epochs to minimize the long-run average number of customers in the system. We show the existence of an optimal threshold-type policy that depends on the number in queue and the status of the servers.

■ TC60

60- Remington- Hyatt

Impacts of Environmental and Quality Programs in the Airline Industry

Sponsor: Aviation Applications

Sponsored Session

Chair: Kushal A. Moolchandani, Purdue University, School of Aeronautics and Astronautics, 701 W. Stadium Avenue, West Lafayette, IN, United States of America, kmoolcha@purdue.edu

1 - Assessing the U.S. Aviation Environmental Impacts using a Duopoly Airlines Model

Kushal A. Moolchandani, Purdue University, School of Aeronautics and Astronautics, 701 W. Stadium Avenue, West Lafayette, IN, United States of America, kmoolcha@purdue.edu, Satadru Roy, Datu B. Agusdinata, Muharrem Mane, Daniel DeLaurentis, William Crossley

The operations of legacy and low-cost carriers in the U.S are simulated under various scenarios of economic conditions and policy implementations. The duopoly model is solved as a resource allocation set up to maximize airlines' profit while meeting market demand. This work also incorporates the ability to model airlines' decisions on retirement and acquisition of aircraft. This study helps assess the resulting emissions and noise impacts and could inform technological development and formulation of policies intended to reduce them.

2 - Impacts of Deploying Six Sigma Quality Control in Airline Operations

Ramesh Bollapragada, Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu, Vivian Chan

The purpose of the paper is to investigate the financial and operational benefits when deploying Six Sigma (SS) methodologies in airlines operations. The Six Sigma continuous improvement methodology DMAIC is used in this study. SS statistical calculations are used to measure the current performance of each critical metric involving operations processes within international and U.S. domestic airlines industry.

3 - Analysis of Economic and Environmental Impact of New Aircraft Concepts via Allocation and Scheduling

Isaac Tetzloff, Graduate Student, Purdue University, 701 W. Stadium Ave., West Lafayette, IN, 47907, United States of America, isaact@purdue.edu, William Crossley

Engineering analyses can predict emissions of new aircraft or technologies; however, evaluating their impact on airline profit and the environment at the fleet-level requires studying the interactions between the new aircraft and the airline's current fleet. Through the use of an aircraft allocation and scheduling tool, decisions on how to deploy new aircraft technologies and concepts within an airline's fleet are quickly made while considering both airline profit and environmental impact.

4 - Does EU ETS Instigate AirCargo Network Reconfiguration? A Model-based Analysis

Ulrich Derigs, Department of Information Systems and Operations Research (WINFORS), University of Cologne, Cologne, Germany, derigs@informatik.uni-koeln.de, Stefan Illing

From 2012 on aviation is included in the European Emissions Trading Scheme (EU ETS) and operators have to hold one allowance per tonne of CO2 emitted on every flight departing from and/or arriving at an airport within the EU. Now two questions are of interest: Is it profitable for airlines to reconfigure their routes to reduce EU-related emissions and costs, and, will the schema be successful in the sense that emissions are reduced significantly. Here the potential for and the consequences of reconfiguration are different for the passenger and cargo business, respectively. In this paper we present a model-based simulation of network (re-)configuration/optimization at cargo airlines under different EU ETS scenarios and we discuss the results with respect to the two issues raised above.

■ TC61

61- Russell- Hyatt

Patrolling Problems in Security

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: David Alderson, Operations Research Department, Naval Postgraduate School, Monterey, CA, United States of America, dlalders@nps.edu

1 - Game Theory for Security: Key Algorithmic Principles, Deployed Applications, Lessons Learned

Milind Tambe, University of Southern California, Los Angeles, CA, United States of America, tambe@usc.edu

We will provide an overview of key principles of several game-theoretic applications developed by my research team at USC that are now deployed over multiple years with multiple security agencies: LAX police, Federal Air Marshals (FAMS), US coast guard in Boston and New York, and Los Angeles Sheriff Department.

2 - Security Games with Limited Surveillance

Bo An, University of Southern California, Los Angeles, CA, United States of America, boa@usc.edu, Yevgeniy Vorobeychik, David Kempe, Christopher Kiekintveld, Milind Tambe, Eric Shieh, Satinder Singh

We model the process of an attacker observing a sequence of resource allocation decisions and updating his beliefs about the defender's strategy. We present exact and approximate computational techniques for updating the attacker's beliefs and computing optimal strategies for both the attacker and defender, given a specific number of observations.

3 - A Patrol Problem from the Adversary's Perspective
Kyle Lin, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd, Monterey, CA, 93943, United States of America, kylin@nps.edu, David Alderson, Michael Atkinson, Tim Chung

Consider a patrol problem, where a defender uses patrols to deter attacks, while an adversary observes and studies the patrol strategy before deciding whether to attack. We use a game-theoretic model to study these interactions and draw insights into the effectiveness of patrols.

■ TC62

62- Borein A- Hyatt

Auctions and the Core

Cluster: Auctions

Invited Session

Chair: Robert Day, Associate Professor, OPIM, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, Bob.Day@business.uconn.edu

1 - Risk Aversion in Ascending Core-selecting Auctions
Ioannis Petrakis, TU München, Room 01.10.055, Boltzmannstr 3, Munich, 85748, Germany, Petrakis.ioannis@gmail.com, Kemal Guler, Martin Bichler

We characterize conditions for the perfect Bayesian equilibria of the ascending core-selecting auction mechanism to have the small bidders to drop at the reserve price with risk-averse bidders. Our first main result is a generalization of the condition for a non-bidding equilibrium in (Sano, 2011), which allows for arbitrary concave utility functions. Second, we discuss this condition in the presence of asymmetries, and third, we provide comparative statics.

2 - Core Deviation Minimizing Auctions
Isa Hafalir, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15217, United States of America, isaemin@cmu.edu

We study dominant strategy implementable direct mechanisms that minimize the expected surplus from core deviations. Using incentive compatibility conditions, we formulate the core deviation miminimization problem as a calculus of variations problem and then numerically solve it for some particular cases.

3 - Core-selecting Auctions with Incomplete Information
Oleg Baranov, Assistant Professor, University of Colorado at Boulder, Department of Economics, 256 UCB, Boulder, CO, 80309, United States of America, Oleg.Baranov@Colorado.edu, Lawrence Ausubel

In this paper, we consider a simple incomplete-information model which allows us to do a full equilibrium analysis for four different core-selecting auction formats suggested in the literature. We find that the revenues and efficiency from core-selecting auctions improve as correlations among bidders' values increase, while the revenues from the Vickrey auction worsen. Thus, there may be good reasons for policymakers to utilize core-selecting auctions rather than a VCG in realistic environments.

■ TC63

63- Borein B- Hyatt

Joint Session Behavioral Oper/Auctions: Behavioral Mechanism Design

Sponsor: Behavioral Operations & Auctions

Sponsored Session

Chair: Elena Katok, Professor, University of Texas Dallas, 800 West Campbell Rd., Richardson, TX, 75080, United States of America, ekatok@psu.edu

1 - Supply Chain Contract Design: Impact of Bounded Rationality and Individual Heterogeneity
Diana Wu, University of Kansas, Lawrence, KS, United States of America, dianawu@ku.edu, Kay-Yut Chen

We model two forms of bounded rationality in a newsvendor setting: the tendency to err and the tendency to anchor. The model is motivated by observations under several types of supply chain contracts in the laboratory. Our experiments show that the behavior of newsvendors follows some multi-modal distribution that responds to contract settings. Moreover, we discover heterogeneity in decision makers' tendencies. New insights on contract design are obtained by applying this behavioral model.

2 - Commitment and Reason in Bargaining with Joint Production
Gary Bolton, Schwartz Professor of Business Economics, Pennsylvania State University, 334 Business Building, University Park, PA, 16802, United States of America, geb3@smeal.psu.edu

We conduct a bargaining experiment with joint production to investigate the relationship between hard leverage (the option to make binding commitments) and soft leverage (appeals to asymmetric focal points) in providing bargaining advantage. Our data is consistent with the hypothesis that reason in the form of focal points bounds the use of commitment.

3 - Investigating Strategic Customer Behavior through an Interactive Supply Chain Game
Pelin Pekgun, Assistant Professor, University of South Carolina, Moore School of Business, 1705 College Street, Columbia, SC, 29208, United States of America, Pelin.Pekgun@moore.sc.edu, Pinar Keskinocak, Tosanwunmi Maku, Mani Janakiram

We investigate the strategic forecasting and ordering behavior of customers through an interactive supply chain game with the motivation of continuously improving supply chain metrics and planning for various scenarios. We discuss the effectiveness of different inventory allocation mechanisms in reducing forecast inflation based on our insights gained from experiments conducted on over 200 human subjects.

4 - Designing Incentive Schemes for Truthful Forecast Information Sharing
Ulrich Thonemann, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, ulrich.thonemann@uni-koeln.de, Lisa Scheele, Marko Slikker

Motivated by structurally biased sales forecasts in practice, we study a forecast sharing situation between a (better informed) sales and a production planning department. Our objective is to incentivize truthful forecasts by applying incentive schemes which penalize forecast errors. We find that experimental observations are at odds with game-theoretic predictions under rationality assumptions and develop a new behavioral model based on theories of reference point dependence and lying aversion.

■ TC66

66- Ellis West- Hyatt

Joint Session DM/QSR: Novel Classification and Clustering Algorithms for Data Mining

Sponsor: Data Mining & Quality, Statistics and Reliability

Sponsored Session

Chair: Seoung Bum Kim, Associate Professior, Korea University, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

Co-Chair: Jun-Geol BaekAssociate Professor, Korea University, Seoul, Korea, Republic of, jungeol@korea.ac.kr

1 - A Recursive Binary Partitioning Algorithm for Clustering Analysis
Jihoon Kang, PhD Student, Korea University, Seoul, Korea, Republic of, joker404@korea.ac.kr, Seoung Bum Kim

Clustering analysis has been conducted to elicit nature groupings of the dataset without prior information about the sample class. In this study, we propose a new clustering algorithm that adopts recursive binary partitioning to achieve the best grouping of the dataset. Experiments with the simulation and real data demonstrate the effectiveness and interpretability of the proposed algorithm.

2 - A Novel Support Vector Data Description Algorithm
Poovich Phaladiganon, PhD Candidate, University of Texas at Arlington, Arlington, TX, United States of America, poovich.phaladiganon@mavs.uta.edu, Seoung Bum Kim, Victoria Chen

Support vector data description (SVDD) is a one-class classification technique, which generates spherical boundary. The goal is to maximize the number of observations and minimize the radius of sphere. The boundary is determined by support vectors (SVs). However, the boundary generated from SVDD does not consider the data density. Thus, we utilize SVs to incorporate data density into SVDD. The preliminary research shows that the proposed method performs better than the existing one.

3 - An Ensemble Classification Algorithm with Clustered Features
Chanhee Park, Korea University, Seoul, Korea, Republic of, chanhee.b@gmail.com, Seoung Bum Kim

In this study, we propose a new classification algorithm based upon a set of features clustered. The features were clustered by a standard clustering algorithm followed by the classification analysis in each clustered feature. We used the simulation and real data to demonstrate the efficiency and usefulness of the proposed algorithm.

4 - The Analysis of Dengue Virus Serotypes via UnitX Representation

Chivalai Temiyasathit, Assistant Professor, King Mongkut's Institute of Technology Ladkrabang, International College, KMITL, Chalongkrung Road, Ladkrabang District, Bangkok, 10520, Thailand, ktchival@kmitl.ac.th, Yodchanan Wongsawat

One of the challenging problems in virus sequence analyses is the graphical representation of the long sequences nucleotides. In this study, a new graphical representation based on the cumulative amount of amino and keto bases, called UnitX method is proposed. Classification tree is then employed to verify the distinguish ability of the projected sequences. Experimental results showed that the proposed method can efficiently distinguish the four serotypes of Dengue virus sequences.

■ TC67

67- Ellis East- Hyatt

Fault Management for Complex Engineering Systems

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Shiyu Zhou, Professor, University of Wisconsin, Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, szhou@engr.wisc.edu

Co-Chair: Qiang Zhou, Assistant Professor, City University of Hong Kong, Hong Kong, Hong Kong - PRC, qzhou3@wisc.edu

1 - A Framework for Variation Visualization and Understanding in Complex Manufacturing Systems

Fadel Megahed, Assistant Professor, Auburn University, 3301L Shelby Center, Auburn, Al, United States of America, fmegahed@vt.edu, Jaime Camelio, William Woodall, Lee Wells

We provide a framework that allows industrial practitioners to visualize the most significant variation patterns. In essence, this framework complements Phase I techniques by enabling users to: (1) acquire detailed understanding of common-cause variability; (2) quickly visualize the effects of common-cause variability in a process with respect to the final product; and (3) identify opportunities for process improvement. The framework is illustrated through a case study.

2 - Optimal Maintenance of Multi-component Systems Considering Component Failure Dependency

Qingyu William Yang, Assistant Professor, Wayne State University, 4815 Fourth Street, Rm 2167, Detroit, MI, 48335, United States of America, qyang@wayne.edu, Nailong Zhang

The interactions between components in multi-component systems complicate the modeling and optimization of maintenance. In this research, we develop optimal maintenance planning for multi-component systems that can capture component failure dependency. A case study of engine assembly system is conducted to verify the developed method.

3 - Quantifying Boundary Effect of Nanoparticles in Metal Matrix Nanocomposite Fabrication Processes

Qiang Zhou, Assistant Professor, City University of Hong Kong, Hong Kong, Hong Kong-PRC, qzhou3@wisc.edu, Micheal De Cicco, Xiaochun Li, Shiyu Zhou, Li Zeng

Lightweight, high strength metal matrix nanocomposites (MMNCs) are promising materials. A uniform distribution of nanoparticles within the metal matrix is critical to its quality. However, a boundary effect often occurs where the nanoparticles tend to gather around the grain boundaries of the metal matrix. We propose a method for quantitatively assessing boundary effect in microstructure images of MMNC samples.

4 - Phase I Change Detection of Quality Profiles in Low-E Glass Manufacturing Processes

Li Zeng, Assistant Professor, The University of Texas at Arlington, 500 West First Street, Arlington, TX, 76019, United States of America, lzeng@uta.edu

The concerns on energy and environment during the past decades have led to the manufacturing of low-emittance (low-E) glass. The current practice of quality monitoring in low-E glass manufacturing processes does not make a full use of the available quality profile measurements in these processes. In this study, we developed Bayesian approaches for the Phase I monitoring of quality profiles in these processes.

■ TC68

68- Suite 312- Hyatt

Financial Engineering & Regulations: From Credit Risk to Energy

Sponsor: Financial Services Section

Sponsored Session

Chair: Tim Leung, Assistant Professor, Columbia University, 308A S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, tl2497@columbia.edu

1 - A Comparison of the Original and Revised Basel Market Risk Frameworks for Regulating Bank Capital

Alexandre Baptista, George Washington University, 2201 G Street Northwest, Washington, DC, 20052, United States of America, alexbapt@gwu.edu, Gordon Alexander, Shu Yan

Risk management systems based on the original and revised Basel market risk frameworks allow the selection of trading portfolios with substantive tail risk. However, a system based on the revised framework tends to be less effective in controlling tail risk. Importantly, the minimum capital requirements in the revised framework are much less likely to be wiped out by trading losses than those in the original framework. Thus, on balance, the revised framework improves upon the original framework.

2 - The Impact of Central Counterparty Design on Credit Default Swap Market

Jinbeom Kim, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, jk3071@columbia.edu

Central clearing of credit default swaps (CDSs) through Central Counterparties (CCPs) has been proposed as a tool for mitigating systemic risk and counterpart risk in CDS markets. We study the impact of the design of capital requirements of a CCP on the incentives for CDS clearing of the CDS inter-dealer market by deriving a unique Nash equilibrium of inter-dealer market CDS demands.

3 - Optimal Collateralization under Bilateral Default Risk

Daniel Bauer, Georgia State University, P.O. Box 4036, Atlanta, GA, United States of America, dbauer@gsu.edu, Luz R Sotomayor, Enrico Biffis

We consider optimal collateralization in OTC transactions with bilateral default risk. In particular, we jointly solve for the transaction price and optimal collateral rules in a setting that takes into account the credit quality and funding needs of both parties. Our framework can be used for understanding Credit Support Annex (CSA) pricing and Credit Value Adjustment (CVA) charges in structuring OTC transactions. Our results provide insights on the key drivers of collateral rules.

4 - New Challenges in Electricity Price Modeling: Emissions, Renewables and Market Coupling

Michael Coulon, Princeton University, ORFE Department, Princeton, NJ, United States of America, mcoulon@princeton.edu

Many electricity markets have recently undergone various fundamental changes linked to new regulations. These include the introduction of emissions markets, the growth of renewables and ongoing cross border integration (particularly in Europe) via a mechanism called market coupling. Such key changes provide major obstacles for traditional reduced-form models of power price dynamics. We discuss these challenges and propose some alternative structural approaches to capturing these new features.

■ TC69

69- Suite 314- Hyatt

Advances in Risk Analysis

Contributed Session

Chair: Seong Dae KimAssistant Professor, University of Alaska Anchorage, 3211 Providence Drive, University Center Room 155, Anchorage, AK, 99508, United States of America, sdkim2@uaa.alaska.edu

1 - Z-Theory and its Application to Risk Assessment and Multi-Criteria Decision Making

Behnam Malakooti, Professor, Case Western Reserve University, 19000 Olin 611, Cleveland, OH, 44106, United States of America, bxm4@case.edu

This paper introduces Z-theory for risk assessment. The advantage of using Z-theory over classical expected utility theory is discussed and its robustness, simplicity, and applicability are explained. It is shown how Z-theory overcomes the disadvantages of Neumann and Morgenstern approach in modeling preferences. The theoretical foundation of Z-theory for decision problems under risk is also presented.

2 - A Framework for Assessing Infrastructure Risk
Julia Phillips, Principal Infrastructure Analyst, Argonne National Lab, 9700 S Cass Ave., Bldg 221, Argonne, IL, 60439, United States of America, phillipsj@anl.gov, William Buehring, Jim Peerenboom, Ron Whitfield, Lon Carlson, Gilbert Bassett

The functional form of Risk =T x V x C has encountered growing criticism, especially in the area of infrastructure risk analysis. We discuss the roots of such criticism and propose a framework in which the risk at a site for a given threat-type is determined by consequences where consequences are represented by a multivariate random variable and the concepts of vulnerability and resilience in our approach become subsidiary/derived properties of the consequences distribution.

3 - Can Project Success be Accurately Predicted within Three Months of Project Launch?
Rose Williams, Senior Technical Research Staff, IBM, 19 Skyline Drive, Hawthorne, 10532, United States of America, rosemw@us.ibm.com

Statistical measures are used to initiate accelerated risk mitigation plans early in a software project's lifecycle. Yet, how early in the lifecycle can an algorithm predict delivery results and expect reasonably accurate outcomes? Drawing upon a historical database of services projects spanning several years, we have developed an index that allows us to predict with reasonable certainty as early as 3 months into the development process — allowing us to plan for risk more effectively.

4 - Characterizing Unknown Unknowns when Facing Natural Disasters
Seong Dae Kim, Assistant Professor, University of Alaska Anchorage, 3211 Providence Drive, University Center Room 155, Anchorage, AK, 99508, United States of America, sdkim2@uaa.alaska.edu

When facing natural disasters, it's hard to manage them because of their uncertain nature. Among different categories of uncertainty, unknown unknowns are known to be the vaguest in their characteristics and, often times, they become a surprising catastrophe due to the fact that they are almost impossible to manage. This paper reviews various ways to characterize uncertainties and seeks for characteristics of unknown unknowns in natural disasters to help make better decision in managing them.

5 - Risk Pooling in Performance-based Logistics
Guangyuan Yang, PhD Candidate, Erasmus Universiteit Rotterdam, Burg. Oudlaan 50 H09-21, Rotterdam, 3062PA, Netherlands, gyang@ese.eur.nl

We assess the benefits of risk polling in PBL and its effects on aleatory uncertainties and epistemic uncertainties. Our results can enhance service performance and/or save costs in PBL by supporting logistics fulfillment of service contracts both at the initial phase (service contract sales) and during contract execution (with operational data).

■ TC70

70- Suite 316- Hyatt

Search and Social Media

Sponsor: Information Systems

Sponsored Session

Chair: Beibei Li, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, bli@stern.nyu.edu

1 - Estimating Demand for Applications in the New Mobile Economy
Sang-Pil Han, Assistant Professor, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong-ROC, sangphan@cityu.edu.hk, Anindya Ghose

We build a structural model of user demand for mobile applications. We use a panel dataset consisting of applications' sales, prices, and characteristics from two leading app stores – Apple App Store and Google Android Market. Results show that demand increases with the filesize of apps, the age of apps, and the length of description. Counterfactual experiments show price discount strategies result in a greater increase of app demand in Apple App Store compared to Google Android Market.

2 - Simultaneous or Sequential? Understanding the Drivers of Search Strategies and Search in the U.S. Auto Insurance Industry
Elisabeth Honka, Assistant Professor of Marketing, University of Texas at Dallas, 800 W. Campbell Road, Richardson, TX, 75080, United States of America, elisabeth.honka@utdallas.edu, Pradeep Chintagunta

Whether consumers use simultaneous or sequential search strategies has long been a question of interest. The difficulty in settling this question stems from the fact that, in most data sets, the type of search is not identified so researchers have to make an assumption regarding the specific search strategy being used. Using a unique data set on consumer shopping behavior in the U.S. auto insurance industry, we study the effects of making either assumption on the type of search.

3 - The Impact of Comments on Microblogging
Yingda Lu, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, yingdal@andrew.cmu.edu, Yong Tan

In this paper, we investigate the impact of comments on user behavior on microblogging platform. We illustrate that comments of microbloggs could influence the way users decide whom to follow, whether to post microblogs. The comments can also influence the way new microblogs spread.

4 - Examining Limited Consumer Search with Social Media and Product Search Engines
Beibei Li, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, bli@stern.nyu.edu, Panagiotis Ipeirotis, Anindya Ghose

We propose a dynamic structural model of limited consumer search and validate it on a dataset of 1M online sessions for hotels. It allows us to monetize the search costs under social contexts. Our policy experiment shows that customized rankings can polarize the distribution of search intensity. Our model also indicates a lower price sensitivity than a static model would predict, implying that consumers pay a lot of attention to non-price factors during an online hotel search.

■ TC71

71- Suite 318- Hyatt

The Internet-Driven Economy

Sponsor: eBusiness

Sponsored Session

Chair: Raymond Sin, Assistant Professor, The University of Hong Kong, Pokfulam, Hong Kong, Hong Kong - PRC, rsin@ust.hk

Co-Chair: Shun Ye, University of Maryland, RH Smith School of Business, College Park, MD, United States of America, sye@rhsmith.umd.edu

1 - Strategic Distribution and IT Investment Decisions in the Face of Digitization: Managerial Guideline
Nelson Granados, Pepperdine University, 15 Cedarlake, Irvine, CA, 92614, United States of America, Nelson.Granados@pepperdine.edu, John Mooney

The media, entertainment, and air travel industries are facing significant transformations due to the digitization of information and content. We use the empirical case study methodology to derive managerial guidelines for distribution strategy and related IT investments in the face of digitization. A tangible result of our work is a framework that enables firms to rationally decide whether to have a direct, joint-owned, or intermediated online distribution.

2 - Online Communities and Sustainability: An Empirical Investigation
Dobin Yim, University of Maryland, 3300 Van Munching Hall, College Park, MD, United States of America, dyim@rhsmith.umd.edu

Fostering consumer-driven energy conservation efforts has sprouted "green" online communities. We examine how online social networks facilitate environmental sustainability through the visibility of sustainable behaviors and group-induced norm. We show that slower growing groups perform better in energy reduction, and the strength of ties and group characteristics that individuals belong to are important predictors of prosocial behaviors.

3 - Overt Management Participation: Responding to Negative Consumer Feedback in Online Review Forums
T. Ravichandran, Professor, Lally School of Management & Technology, RPI, 110 Eighth Street, Troy, NY, 12180, United States of America, ravit@rpi.edu, Stacey Sharpe, Dongling Huang

In this paper we study the impact of managerial response strategies aimed at mitigating the potential implications of negative feedback generated by consumers in online review forumsófocusing specifically on factors related to the source and content of the managerial response. Using data collected from TripAdvisor.com on over 67000 consumer hotel reviews and corresponding responses from hotel administrators across two cities over ten years, we test our research hypotheses.

4 - Social Media, Conventional Media, and Stock Market Performance: A Sentiment Analysis Approach
Wenjing Duan, Assistant Professor, The George Washington University, 2201 G Street, NW, Washington, DC, 20052, United States of America, wduan@gwu.edu, Qing Cao, Yang Yu

This study aims to investigate the effect of social media and conventional media, their relative importance, and their interrelatedness on firm stock market performances. We use a novel and large-scale dataset that features daily media content across various social media and conventional media outlets for 862 public traded firms. We apply the advanced sentiment analysis technique to analyze the overall sentiments of each media resource toward a specific company on the daily basis.

■ TC72

72- Suite 322- Hyatt

Exploration, Search, and Learning

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Ilya Ryzhov, University of Maryland, 4322 Van Munching Hall, College Park, MD, 21044, United States of America, iryzhov@rhsmith.umd.edu

1 - An Approximate Dynamic Programming Approach to Sponsored Search
Andrew Mastin, PhD Student, Massachusetts Institute of Technology, Room 32-D642, Cambridge, MA, 02139, United States of America, mastin@mit.edu, Warren Powell, Patrick Jaillet

We present an approximate dynamic programming algorithm for online advertisement allocation in sponsored search (frequently referred to as the Adwords problem). Using an approximation architecture based on piecewise linear separable value function approximations, we show empirical performance values greater than 99% of posterior solutions for problem instances where myopic polices are theoretically proven to perform poorly. We also show experimental results based on real search engine data.

2 - Controlling Greedy Sample Bias through Bias Corrrected Q Learning
Donghun Lee, Princeton University, 35 Olden Street, Princeton, NJ, 08540, United States of America, donghunl@princeton.edu, Warren Powell

We define non-negative bias caused by greedy sampling in exploitation steps of reinforcement learning using value estimation. We propose additive bias correction framework and apply it to Q learning to construct bias-corrected Q learning. Significant bias reduction and accelerated policy learning are demonstrated in Roulette simulation and intelligent battery control in power grid simulation.

3 - Learning to Learn
Benjamin Van Roy, Stanford University, 273 Packard, Stanford, CA, United States of America, bvr@stanford.edu

We will discuss the importance of learning to learn, and how this is a distinctive element of reinforcement learning relative to other areas of statistical learning. We will then survey some relevant research and discuss recent work on an algorithm that efficiently learns to learn (and learns) in dynamic systems with arbitrarily large state spaces by combining optimistic exploration and value function generalization.

4 - The Robust Approach to Simulation Optimization
Ilya Ryzhov, University of Maryland, 4322 Van Munching Hall, College Park, MD, 21044, United States of America, iryzhov@rhsmith.umd.edu, Boris Defourny, Warren Powell

Simulation can be used to learn about a decision-maker's environment and improve a future implementation decision (a system design, management policy, investment decision, etc.). The simulation optimization literature often assumes that decision-makers are risk-neutral. Robust optimization can be used to approach the problem from a risk-averse perspective. We formulate the risk-averse problem and propose a way to allocate the simulation budget based on an economic improvement criterion.

■ TC73

73- Suite 324- Hyatt

Production Planning

Contributed Session

Chair: Ali Kefeli, Operations Research Specialist, Kimberly-Clark Corp., 1400 Holcomb Bridge Rd, Atlanta, GA, 30076, United States of America, akefeli@ncsu.edu

1 - Feedback Control of Machine Startup for Energy-Efficient Manufacturing in Bernoulli Serial Lines
Guorong Chen, University of Wisconsin-Milwaukee, 3955 N Murray Ave., apt 601, Milwaukee, WI, 53211, United States of America, gchen@uwm.edu, Liang Zhang, Jorge Arinez, Stephan Biller

Energy efficiency in manufacturing systems can be effectively improved by proper control of machine startup schedule. This paper derives closed-form formulas for performance measures in transient period, analyzes system theoretic properties, proposes effective controllers for machine startup schedule with examples, and thus illustrates the effectiveness of energy consumption reduction via proper machine startup control.

2 - Bi-Objective Optimization for Aggregate Planning with Flexibility Requirements Profile
Edil Demirel, Teaching Assistant in Lee College of Engineering, The Universirty of North Carolina at Charlotte, 9201 University City Blvd., Cameron Building Room 291-A, Charlotte, NC, 28223, United States of America, edemirel@uncc.edu, Churlzu Lim, Ertunga C. Ozelkan

Demand uncertainty causes changes in production plans, which create nervousness in organizations. Flexibility Requirements Profile (FRP) is an approach to reduce variability in production plans. This study proposes a bi-objective optimization model for FRP-based aggregate planning, where the trade-off between plan stability and production cost is investigated through a design of experiments framework.

3 - A Genetic Algorithm for the Integrared Production, Inventory, Distribution Routing Problem
Nihan Kabadayi, Research Asistant, Istanbul University, I.U. Faculty of Business Administration, Avcilar, 34320, Turkey, nihank@istanbul.edu.tr, Timur Keskinturk

In this study, we aim to solve the integrated production, inventory,distribution routing (IPIDR) problem with using genetic algorithm (GA). The objective of the problem is to find optimal production quantity, customer delivery quantity and schedule in order to minimize the total system cost which is composed of production setup cost, inventory holding costs and distribution cost. We have developed a genetic algorithm to solve the IPIDR in an integrated manner.

4 - Testing the Quality of Personnel Rosters for Aircraft Line Maintenance
Jorne Van den Bergh, PhD Student, HUBrussel, Warmoesberg 26, Brussels, 1000, Belgium, jorne.vandenbergh@hubrussel.be, Jeroen Beliën, Liesje De Boeck, Philippe De Bruecker, Erik Demeulemeester

We present a simulation approach for the evaluation of personnel rosters of an aircraft maintenance company located at Brussels Airport. When constructing the rosters, the timing of the workloads was considered to be deterministic. The rosters are evaluated by simulating stochastic arrival times. We compare the real-world allocation method to other rules and analyze the performance of the different rosters by DEA.

5 - Duality of Capacity Constraints in Production Planning
Ali Kefeli, Operations Research Specialist, Kimberly-Clark Corp., 1400 Holcomb Bridge Rd, Atlanta, GA, 30076, United States of America, akefeli@ncsu.edu

In this talk, we explore the dual behavior of the conventional method of capacity modeling. To gain insight we focus on the dual prices of capacity in a single stage single product production-inventory system. We derive closed form expressions of the dual variables and discuss the limitations of the modeling technique, in particular under which conditions they produce positive dual prices. We conclude with an exposition of an alternate capacity modeling technique with clearing functions.

Tuesday, 4:30pm - 6:00pm

■ TD01

01- West 101- CC

Integer Programming and Network Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: J. Cole Smith, Professor, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, cole@ise.ufl.edu

1 - Improve Power Grid with Controllable Reactance

Feng Pan, Los Alamos National Lab, Los Alamos National Lab, Los Alamos, NM, 87545, United States of America, fpan@lanl.gov

In a flexible AC transmission system, line reactance can be adjusted to improve a power grid's performance. We use a linearized DC flow model to approximate power grid. With line reactance being decision variables, a bilevel program is developed to find an optimal setting of reactance on power lines. We discuss solution approaches and simulation results.

2 - Optimal Edge Search for an Immobile Hider with Imperfect Detection Probability

Shantih Spanton, University of Florida, Gainesville, FL, 32611, United States of America, sspanton@ufl.edu, Joseph Geunes, J. Cole Smith

We consider the problem of a single searcher traversing a network to find an immobile hider. The likelihood of finding the hider upon a particular edge decreases with each traversal the searcher makes upon the edge. Given a finite search time limit the problem maximizes the searcher's probability of finding the hider on the network.

3 - An Algorithm for Bilevel Integer Interdiction

Yen Tang, University of Florida, 303 Weil Hall, Gainesville, United States of America, yentang@ufl.edu, Jean-Philippe Richard, J. Cole Smith

We propose a new algorithm for finding globally optimal solutions to a family of bilevel integer interdiction optimization in which the upper level minimizes the maximum of the objective of the lower level problem. We show that this algorithm, which proceeds by progressively building a suitable restriction of the lower level problem, is finitely convergent. We then present the results of a computational study aimed at evaluating the quality of our algorithm.

■ TD02

02- West 102 A- CC

Joint Session DA/INFORMS Journals: Special Issue of Decision Analysis on Games and Decisions in Reliability and Risk

Sponsor: Decision Analysis & INFORMS Journals Cluster

Sponsored Session

Chair: Jason Merrick, Professor, Virginia Commonwealth University, Statistics & Operations Research, P.O. Box 843083, Richmond, VA, 23284, United States of America, jrmerric@vcu.edu

Co-Chair: Fabrizio Ruggeri, Research Director, CNR-IMATI, Via Bassini, 15, Milano, 20133, Italy, Fabrizio@mi.imati.cnr.it

Co-Chair: Refik Soyer, Professor of Decision Sciences, George Washington University, 2201 G Street, Washington, DC, United States of America, soyer@gwu.edu

1 - Adversarial Risk Analysis: The Somali Pirates Case

Jesus Rios, IBM, Yorktown Heights, NY, United States of America, jriosal@us.ibm.com, David Rios Insua, Juan Carlos Sevillano

We show how Adversarial Risk Analysis may cope with a current important security issue in relation with piracy in the Somali coasts. Specifically, we describe how to support the owner of a ship in managing risks from piracy in that area. We illustrate how a sequential defend-attack-defend model can be used to formulate this decision problem and solve it for the ship owner. Our formulation models the pirates' behavior through the analysis of how they could solve their decision problem.

2 - Modeling State-dependent Priorities of Malicious Agents

Sumitra Sri Bhashyam, PhD Candidate, London School of Economics, Houghton Street, London, United Kingdom, S.Sribhashyam@lse.ac.uk, Gilberto Montibeller

One way to anticipate terrorists' malicious actions is to consider their values when modeling their decisions - such values will drive their choices. Using multi-attribute utility theory we suggest modeling dynamic preferences of a malicious agent by incorporating state-dependent weights to account for preference change caused by exogenous triggers and representing the environment as a system dynamics model. We explore its use in the context of counter-terrorism analysis.

3 - Regulation Games Between Government and Competing Companies: Oil Spills and Other Disasters

Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, May Cheung

Oil spills are a characteristic risk. There are safety regulations set to reduce the risk. Companies are balancing between safety efforts and production competition with other companies. We model and compare two games: a one-company game without competition and a two-company game with competition, both with the government as a regulator. Our results indicate that competition increases a company's threshold for risk and therefore requires stricter government regulation.

■ TD03

03- West 102 B- CC

Resource Allocation and Investment Decisions

Sponsor: Decision Analysis

Sponsored Session

Chair: Juuso Liesio, Teaching Research Scientist, Aalto University, Department of Mathematics and Systems Analysis, P.O. Box 11100, Aalto, 00076, Finland, juuso.liesio@aalto.fi

1 - Bayesian Evaluation and Selection Strategies in Portfolio Decision Analysis

Eeva Vilkkumaa, Aalto University, P.O. Box 11100, Aalto, 00076, Finland, eeva.vilkkumaa@aalto.fi, Juuso Liesio, Ahti Salo

In project portfolio selection, the projects' future values are typically uncertain. We show how the Bayesian modeling of these uncertainties increases the expected value of the portfolio, raises the expected number of optimal projects in the portfolio and decreases post-decision disappointment. We also show that it pays off to re-evaluate only those projects that can be re-evaluated relatively accurately and that have particularly uncertain initial value estimates near the selection threshold.

2 - Measurable Multiattribute Value Functions for Portfolio Decision Analysis

Juuso Liesio, Teaching Research Scientist, Aalto University, Department of Mathematics and Systems Analysis, P.O. Box 11100, Aalto, 00076, Finland, juuso.liesio@aalto.fi

The linear-additive value model (i.e. portfolio value is the sum of additive multiattribute project values) is widely employed to support multiobjective project portfolio selection even though the underlying preference assumptions do not often hold in practice. We relax these assumptions and derive a more general class of multilinear portfolio value functions. Furthermore, we develop techniques to elicit these value functions and algorithms to identify the optimal project portfolio.

3 - Resource Based Path Dependency and Risk Aversion

Janne Kettunen, Assistant Professor, Haskayne School of Business, 2500 University Drive N.W., Calgary, AB, Canada, jskettun@ucalgary.ca, Derek Bunn

We provide reasons for the origin of firm's resource based heterogeneity. Given heterogeneous existing resources, we show that it is optimal for a firm with hedgeable existing assets to signal that it is more risk averse. Also, we show that steps toward asset diversification are path dependent as a function of time. For policy makers, our results suggest that if resource based path dependency is not considered policy impacts can be significantly different than what expected.

4 - Communicating Decision Analytic Results to Decision Makers

Patrick Noonan, Professor in the Practice of Decision & Info. Analysis, Emory University, 1300 Clifton Road NE, Goizueta Business School, Atlanta, GA, 30322, United States of America, pnoonan@emory.edu, Jeff Keisler

Good analysis is not enough to define success in a decision analysis (DA) engagement. Good communication of analytical results helps stakeholders to understand, accept and implement recommendations. DA itself provides several useful frameworks for approaching the decision of how to communicate. Standard communication techniques in DA engagements can be improved further by drawing on insights from other areas of management practice.

■ TD04

04- West 102 C- CC

Data Envelopment Analysis IV

Cluster: Data Envelopment Analysis

Invited Session

Chair: Andrew Johnson, Texas A & M University, 4033 ETB, College Station, TX, United States of America, ajohnson@tamu.edu

1 - A DEA Study of Sustainable Energy Efficiency in New Zealand

Julie Harrison, Senior Lecturer, University of Auckland, Department of Accounting & Finance, 12 Grafton Road, Auckland, New Zealand, j.harrison@auckland.ac.nz, Paul Rouse, Jennifer Chen

Our study examines macro-level energy efficiency trends in New Zealand from 1990 to 2009. During this period the NZ government implemented a number of sustainability initiatives, including the adoption of the Kyoto Protocol. We use a DEA model that combines greenhouse gas emissions data and total factor energy efficiency measures. The results show improvements in energy efficiency, with the largest improvements concurrent with the introduction of major government initiatives on sustainability.

2 - Assessment and Identification of Efficient Strategies for Prevention of Obesity

Nasim Sabounchi, Virginia Technical University, 7054 Haycock Road, Room 433, Falls Church, VA, 22044, United States of America, sabounchi@vt.edu, Kostas Triantis

Due to the increasing obesity trend, we need to identify the most efficient and sustainable intervention strategies in turning the obesity trend. Our objective is to study how efficiency in implementing the obesity interventions, affects resources required, intervention capabilities, and obesity mitigation. We adopt a DEA approach to find appropriate model specifications, define the inputs, outputs and outcomes for the transformation process and present insights in evaluating obesity policies.

3 - Supplier Evaluation and Resilient Base Identification in Presence of Supply Disruptions

Anthony Ross, Professor, University of Wisconsin Milwaukee, P.O. Box 742, Milwaukee, WI, 53201, United States of America, antross@uwm.edu, Wanxi Li, Kaan Kuzu

This study investigates suppliers' performance under performance outcome uncertainty, and further explores the resilience of supplier's performance in disrupted environment. We propose a framework to evaluate suppliers' performance capabilities in the context disruption occurrences. Such a framework may assist supply managers in proactively mitigating the potential impact of the disruption by understanding capabilities imbedded within the supply base. Several managerial insights are discussed.

4 - Allocative Efficiency in an Oligopolistic Market: An Example of Rational Inefficiency

Andrew Johnson, Texas A & M University, 4033 ETB, College Station, TX, United States of America, ajohnson@tamu.edu, Chia-Yen Lee

This paper models the production possibility set and the inverse demand function to identify a Nash equilibrium and improvement targets which may not be on the production frontier. This behavior is referred to as rational inefficiency because the firm reduces its productivity levels in order to increase profits. For a general multiple input/output production process which allows a firm to adjust variable input and output levels, the existence and the uniqueness of the Nash equilibrium is proven.

■ TD05

05- West 103 A- CC

Technometrics Invited Session New Directions in Statistical Process Control

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Roshan Vengazhiyil, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu

1 - On Nonparametric Statistical Process Control of Univariate Processes

Peihua Qiu, Professor, University of Minnesota, 224 Church Street SE, 313 Ford Hall, Minneapolis, MN, 55455, United States of America, qiuxx008@umn.edu, Zhonghua Li

This paper considers statistical process control (SPC) of univariate processes when the parametric form of the process distribution is unavailable. We propose a new framework for constructing nonparametric control charts, by first categorizing observed data and then applying categorical data analysis methods to SPC. Some new nonparametric control charts are proposed and they are compared with several representative existing control charts in various cases.

2 - A LASSO-Based Diagnostic Framework for Multivariate Statistical Process Control

Wei Jiang, Professor, Shanghai Jiaotong University, Antai College of Economics & Management, Shanghai, China, jiangwei@sjtu.edu.cn, Fugee Tsung, Changliang Zou

Accurate fault diagnosis of responsible factors has become increasingly critical in a variety of applications. Conventional statistical process control (SPC) methods are often computationally expensive. We frame fault isolation as a two-sample variable selection problem to provide a unified diagnosis framework based on Bayesian information criterion (BIC). A practical LASSO-based diagnostic procedure is proposed which combines BIC with the popular adaptive LASSO variable selection method.

3 - Discussion

Arthur Yeh, Professor, Bowling Green State University, Wooster Street, Ann Arbor, OH, 43403, United States of America, byeh@bgsu.edu

I will discuss the presented papers and give general thoughts about the future of statistical process control.

4 - Discussion

Daniel Apley, NorthWestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, apley@northwestern.edu

I will discuss the presented papers and give general thoughts about the future of SPC.

■ TD06

06- West 103 B- CC

Agent-based Simulation of Complex Adaptive Systems

Sponsor: Simulation

Sponsored Session

Chair: Moeed Haghnevis, Graduate Research and Teaching Associate, Arizona State University, Tempe, AZ, 85287-8809, United States of America, mhaghnev@asu.edu

1 - Scalability of Modeling Driver's Behavior under the Extended Belief-desire-intention Framework

Sojung Kim, The University of Arizona, 1127 E. James E, Rogers Way, Tucson, AZ, 85721, United States of America, sojungkim@email.arizona.edu, Hui Xi, Young-Jun Son

While the extended Belief-Desire-Intention (BDI) framework allows us to mimic realistic driver behaviors, it is computational demanding when applied to a large traffic network. This paper aims at analyzing the relationship between model scalability and network complexity. By comparing the return of investment of employing different modeling methodologies, we intend to find the scenarios in which the extended BDI framework can achieve high performance in terms of both accuracy and efficiency.

2 - Agent-based Simulation of Healthcare Systems with Real-time Data Feeding

Xueping Li, University of Tennessee, 408 East Stadium Hall, Knoxville, TN, 37996, United States of America, Xueping.Li@utk.edu, Tom Berg, Joe Wilck

Real-time location services (RTLS), such as Wifi-based RFIDs, have attracted increasing interest in healthcare systems. We present the simulation models that we developed for the Y-12 Occupational Health Services (OHS) clinic in which we use agents to fetch sensor data and feed the models in real time. A management system was developed to assist the end-users with a dashboard system to provide real-time system status. Optimization and predictive modeling functions were integrated in the system.

3 - An Agent-based Dynamic Laboratory for Electricity Consumption Complex System

Moeed Haghnevis, Graduate Research and Teaching Associate, Arizona State University, Tempe, AZ, 85287-8809, United States of America, mhaghnev@asu.edu, Dieter Armbruster, Ronald Askin

The objective of this research is to construct an agent-based platform and toolkit that creates a dynamic laboratory to study properties and behavior of electric power grid supply and consumption networks and related engineered complex adaptive systems. In addition to developing an understanding of structural behavior, social networking interactions and consumer behaviors are integrated to manage demand in an environment with bi-directional information flow and variable supply.

■ TD07

07- West 104 A- CC

Forecasting

Contributed Session

Chair: Martin Braun, Intel Corp, 5000 W. Chandler Blvd, Chandler, AZ, 85295, United States of America, martin.w.braun@intel.com

1 - Determining the Right Buffer Strategy during Red River Floods, ND, MN

Luke Holt, Graduate Assistant, North Dakota State University: Transportation and Logistics Program, 7080 148th Ave., NE, Grafton, ND, 58237, United States of America, luke.holt@ndsu.edu, Joseph Szmerekovsky, Jiang Zhang, Lihui Bai

The Red River of the North has created flooding problems to North Dakota and Minnesota for many years. water levels are highly unpredictable from year to year. Planners face the challenge to determine what buffer strategy provides appropriate protection. Dynamic programming is used to determine the best buffer strategy.

2 - Scenarios as Support Tools for Judgmental Forecasts

M.Sinan Gonul, Assistant Professor, METU, Department of Business Administration, Middle East Technical University, Ankara, 06800, Turkey, msgonul@metu.edu.tr, Dilek Onkal, K.Zeynep Sayim

This study examines the effects of providing scenarios on individual and group-based judgmental predictions. In the individual forecasting stage, participants are presented with: i) no scenarios, ii) best-case scenarios, iii) worst-case scenarios, iv) both best-case and worst-case scenarios. For the group forecasting stage, members of dyads may be assigned: a) no scenarios, b) different scenarios, c) both scenarios. Findings are discussed and implications for future research are given.

3 - Can Oil Prices be a Proxy for Consumer Sentiment?

Michelle Tuveson, University of Cambridge Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, m.tuveson@jbs.cam.ac.uk, Daniel Ralph

Efficient Market Hypothesis states that income and prices are related to spending irrespective of the behavioral dynamics contributing to economic activity. Research around consumer sentiment has largely focused on its use as a predictive measure on economic forecasts. We pose that consumer sentiment measures are informative metrics for conveying general mood within the macro-economy. Oil price data is shown to be a significant comparative proxy using machine learning applications.

4 - Applying Adaptive EWMA Tuning Methods to the Demand Forecast Problem

Martin Braun, Intel Corp, 5000 W. Chandler Blvd, Chandler, AZ, 85295, United States of America, martin.w.braun@intel.com

Applying EWMA and other filtering methods to demand forecast error for bias and noise estimation can be difficult due to noise characteristics varying with time. A few adaptive methods of tuning EWMA filters are applied successfully in the case of continuous and intermittent demand forecasting problems.

■ TD08

08- West 104 B- CC

Joint Session PPSN/HAS: Health Care Policy Analysis

Sponsor: Public Programs, Service and Needs & Health Applications Society

Sponsored Session

Chair: David Hutton, University of Michigan, 1415 Washington Heights, SPH II: M3525, Ann Arbor, MI, 48109, United States of America, dwhutton@umich.edu

1 - Cost-effectiveness of Risk-factor Guided and Universal Screening for Chronic Hepatitis C

Shan Liu, Stanford University, Stanford, CA, 94305, United States of America, shanliu@stanford.edu, Lauren Cipriano, Mark Holodniy, Jeremy Goldhaber-Fiebert

U.S. guidelines conflict over population screening for chronic hepatitis C. We assessed the cost-effectiveness of universal and risk-factor guided screening for asymptomatic adults followed by one of three treatment strategies. Statistical analyses of the National Health and Nutrition Examination Survey estimated sex-, race-, age-specific risk factor prevalence and mortality risks. Universal screening is likely cost-effective.

2 - Optimal Health Program Intervention with Information Acquisition

Lauren Cipriano, Stanford University, Huang Engineering Center, 475 Via Ortega, Stanford, CA, 94305, United States of America, cipriano@stanford.edu, Thomas Weber

We consider a cohort-specific health-intervention decision as an optimal stopping problem. Across successive periods a given age cohort's imperfectly observable disease prevalence evolves randomly. To inform the stopping decision it is possible to collect a costly sample, the size of which is subject to optimization. We determine an optimal program-continuation and information-collection policy and, as application, propose an optimal testing program for hepatitis C at routine medical visits.

3 - Optimizing Age-specific Screening Strategy for Genital Chlamydia Infections in Women

Nan Kong, Assistant Professor, Purdue University, 206 S. Martin Jischke Drive, West Lafayette, IN, United States of America, nkong@purdue.edu, Yu Teng, Wanzhu Tu

Genital chlamydia infection is a common sexually transmitted disease. Since most infected individuals are asymptomatic and the incidence rate differs by age, we conduct a cost-effectiveness analysis on age-specific screening strategies. We present a discrete-time optimal control problem with cumulative care cost and terminal prevalence as the objectives. We solve the problem with respect to several age-specific screening strategies and address the computational efficiency issue.

4 - Analyzing the Impact of Government Participation on the U.S. Healthcare Financing System

Zhen Zhu, Purdue University, 315 N. Grant Street, West Lafayette, IN, United States of America, zzhu@purdue.edu, Andrew Liu, Nan Kong

In healthcare financing, over-utilization and insurance overhead are two major structural costs that do not contribute to well-being. We consider a mechanism design problem, for which we formulate as a leader-follower game. The government is the leader who intends to minimize the total structure cost, and the representative private insurer is the follower who intends to maximize its profit. Three mechanisms are studied and numerical analysis is conducted based on the RAND HIE data.

■ TD09

09- West 105 A- CC

Preference Learning II

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Salvatore Greco, Professor, University of Catania, Corso Italia 55, Catania, 95129, Italy, salgreco@unict.it

1 - Predicting Manhole Events in New York City

Cynthia Rudin, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rudin@mit.edu

I will describe the Columbia/Con Edison Manhole Events Project, the goal of which is to predict electrical failures, namely manhole fires and explosions in New York City. I will discuss the data mining process by which we transformed extremely raw historical Con Edison data into a ranking model that predicts manhole vulnerability. Our ranked lists are currently assisting with the prioritization of future inspections and repairs in Manhattan, Brooklyn, and the Bronx.

2 - Interactive Evolutionary Multicriteria Scheduling

Jon Marquis, jonemailbox1@gmail.com, John Fowler, Esma Gel, Murat Koksalan, Jyrki Wallenius, Pekka Korhonen

We show an approach to multicriteria parallel machine job scheduling that uses an interactive genetic algorithm to assign jobs to machines and a scheduling heuristic to order those jobs. The algorithm interacts with the decision maker to elicit preference information and guide the algorithm's search. We demonstrate the algorithm's effectiveness for two and three criteria problems.

■ TD10

10- West 105 B- CC

New Models and Algorithms for Discrete Optimization with Uncertainty

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Bo Zeng, Assistant Professor, University of South Florida, 4202 E Fowler Ave ENB118, Tampa, FL, 33620, United States of America, bzeng@usf.edu

1 - An Approximation Method to Solve Two-stage Stochastic Program

Yu An, University of South Florida, 3602 Jefferson Commons Drive Apt302, Tampa Fl 33613, tampa, Fl, 33613, United States of America, yan2@mail.usf.edu, Bo Zeng, Long Zhao

Two-stage stochastic program is known computational challenging as a large number of scenarios need to consider. In this research, we consider to approximate stochastic programs, especially stochastic MIP problems, by solving a series of two-stage robust optimization problems with disjoint uncertainty sets. Preliminary computational results will be presented to evaluate the performance of this approximation strategy.

2 - A Benders' Decomposition Algorithm for Chance-Constrained MIPs

Ludwig Kuznia, Walt Disney World, 1375 E. Buena Vista, Lake Buena Vista, United States of America, lkuznia@mail.usf.edu, Bo Zeng

In this presentation, an innovative application of Benders' decomposition is presented as a solution method for chance-constrained MIPs. Roughly speaking, this can be viewed as a two-phase approach. In the first phase, valid cutting planes are found by solving a relaxed problem. This information is used to seed the Benders' algorithm in the second phase.

3 - Branch-and-Cut Algorithms for Chance-constrained Packing Problem

Yongjia Song, University of Wisconsin-Madison, 1513 University Avenue, 3241 Mechanical Engineering Building, Madison, United States of America, ysong29@wisc.edu, James Luedtke, Simge Kucukyavuz

We study the chance-constrained packing problem with random item weights. We propose new inequalities based on probabilistic covers and strategies for lifting them. We also present a decomposed projection from the extended MIP formulation.

4 - A Two-stage Stochastic Programming Model for Phlebotomist Scheduling in Hospital Laboratories

Laquanda Leaven, PhD Candidate, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27401, United States of America, ltleaven@ncat.edu, Xiuli Qu

Laboratory services in healthcare systems play a vital role in inpatient care. Most hospital laboratories face the challenge to reduce cost and improve service quality. In our study, a Two-Stage Stochastic Programming Model was formulated to determine better phlebotomist schedules for the preanalytical stage of the testing process in hospital laboratories. The objective is to balance the workload among shifts and the workload among phlebotomists in each shift, which result in cost reductions.

■ TD11

11- West 105 C- CC

Algorithms for Nonlinear Optimization and Optimal Control

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Andreas Waechter, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, Waechter@iems.northwestern.edu

1 - Hot Started NLP Solvers: Algorithms

Andreas Waechter, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, Waechter@iems.northwestern.edu, Travis Johnson

We discuss an algorithm for quickly solving a sequence of closely related nonlinear continuous optimization problems, e.g., during the solution of MINLPs or optimal control problems. The algorithm exploits hot-starts of active-set QP solvers, avoiding the refactorization of KKT matrices. This presentation describes the details of the algorithm.

2 - Hot Started NLP Solvers: Applications and Numerical Experiments

Travis Johnson, Northwestern University, 2145 Sheridan Road, Engineering Science/Applied Math, Evanston, IL, 60208, United States of America, traviscj@traviscj.com, Andreas Waechter

We discuss an algorithm for quickly solving a sequence of closely related nonlinear continuous optimization problems, e.g., during the solution of MINLPs or optimal control problems. The algorithm exploits hot-starts of active-set QP solvers, avoiding the refactorization of KKT matrices. This presentation examines the numerical performance of the method.

3 - Scalable Dynamic Optimization

Victor Zavala, Argonne National Laboratory, Mathematics & Computer Science Division, Chicago, IL, 60439, United States of America, vzavala@mcs.anl.gov

We discuss scalability issues arising in dynamic optimization and present potential strategies to avoid them. In particular, we present alternatives to enable fast active-set detection and matrix-free implementations.

■ TD12

12- West 106 A- CC

Algorithmic Learning Theory

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Karthekeyan Chandrasekaran, Georgia Institute of Technology, 266 Ferst Drive, KACB 2116, Atlanta, GA, 30332, United States of America, karthe@gatech.edu

1 - Structure from Local Optima: Learning Subspace Juntas via Higher Order PCA

Ying Xiao, Georgia Institute of Technology, 266 Ferst Drive, Atlanta, GA, 30332, United States of America, ying.fe.xiao@gmail.com, Santosh Vempala

Our result is an algorithm for generalized Independent Component Analysis that uses local optima of high moments to recover the component subspaces of a product distribution. If one component is k-dimensional while the other is "noise" modeled as an (n-k)-dimensional Gaussian, the algorithm is polynomial in n. We use this to learn a k-subspace junta, a labeling function determined by an unknown k-dimensional subspace, which is a generalization of learning a junta.

2 - Distributed Non-stochastic Experts

Varun Kanade, Harvard University, 33 Oxford Street #138, Cambridge, MA, 02138, United States of America, vkanade@fas.harvard.edu, Zhenming Liu, Bozidar Radunovic

We consider the non-stochastic experts problem in a distributed system with k sites and one co-ordinator node that communicates with all sites. On any round a site has to choose an action: the tradeoff being between using stale information or using communication to get latest information. Recent techniques in streaming and distributed optimization literature do not yield non-trivial algorithms. We give a novel algorithm that simultaneously achieves good regret bounds and sublinear communication.

3 - Stability Yields a PTAS for k-Median and k-Means Clustering

Pranjal Awasthi, CMU, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, pawasthi@cs.cmu.edu, Avrim Blum, Or Sheffet

We present a new notion of clustering stability under which one can design polynomial time approximation schemes for k-means and k-median clustering objectives. Our result improves upon previous work of [Ostrovsky'06] and [Balcan, Blum, Gupta'09].

■ TD13

13- West 106 B- CC

Strong Formulations and Cutting Planes for MIP

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Ismael de Farias, Texas Tech University, Department of Ind. Eng, Lubbock, TX, 79409-3061, United States of America, ismael.de-farias@ttu.edu

1 - Computations with Decomposition Algorithms using Gomory Cuts for 2-Stage Stochastic IPs

Dinakar Gade, Ohio State University, 1971 Neil Ave., Columbus, United States of America, gade.6@osu.edu, Simge Kucukyavuz, Suvrajeet Sen

We consider a class of two-stage stochastic integer programs with binary variables in the first stage and general integer variables in the second stage. We develop a finitely convergent decomposition scheme utilizing Gomory cuts to obtain iteratively tighter approximations of the second stage integer programs. We present computational experiments that illustrate the use of these cuts both within a pure cutting plane, as well as a branch-and-cut based decomposition algorithm.

2 - A Computational Study of Linear and Integer Optimization with Multiple-Choice Restrictions

Ismael de Farias, Texas Tech University, Department of Ind. Eng, Lubbock, TX, 79409-3061, United States of America, ismael.de-farias@ttu.edu, Ernee Kozyreff, Ming Zhao

A wide variety of applications require that certain variables have value zero in a feasible solution when other specific variables are nonzero. Such constraints are called multiple-choice. We present new inequalities for solving multiple-choice optimization through branch-and-cut, and an extensive computational experience that reveals new and surprising facts about these problems, their formulations, and the cutting planes.

3 - Strong Formulations for Convex Functions Over Nonconvex Sets

Daniel Bienstock, Columbia University, Department of IEOR, New York, NY, United States of America, dano@columbia.edu, Alex Michalka

We describe continuing work for obtaining the convex hull of sets representing quadratic polynomials over nonconvex sets, such as the complement of a polyhedron, the complement of a paraboloid, or the complement of a union of polyhedra and paraboloids.

4 - Column Generation Stabilization using Dual Smoothing: Theory and Practice

Francois Vanderbeck, Université de Bordeaux, Institut de Mathématiques, Bordeaux, France, fv@math.u-bordeaux1.fr, R. Sadykov, E. Uchoa, J. Han, P. Pesneau, A. Pessoa

Cutting plane algorithmic strategies translate into stabilization procedures for column generation. Some techniques independently developed in the literature are in fact dual equivalent of one another. The link between in-out separation and dual price smoothing helps to establish convergence proves and effective smoothing auto-regulating strategies that avoids the need for parameter tuning. We develop dual smoothing and provide bench- mark against existing stabilization techniques.

■ TD14

14- West 106 C- CC

Scheduling Models and Applications

Cluster: Scheduling and Project Management

Invited Session

Chair: Hui-Chih Hung, Assistant Professor, National Chiao Tung University, MB103, 1001, University Rd., Hsin-Chu, 300, Taiwan - ROC, hhc@nctu.edu.tw

1 - Scheduling Subject to Fixed Job Sequences

Bertrand Lin, Professor, National Chiao Tung University, 1001 Tahsueh Road, Hsinchu, 300, Taiwan-ROC, bmtlin@mail.nctu.edu.tw, Feng-Jang Hwang

In most scheduling problems, if job/operation sequences on the machines are known, then the best schedules corresponding to the given sequences can be easily derived. For some problems, determining such schedules is however non-trivial. This talk discusses several scheduling problems with this aspect by presenting dynamic programming algorithms and NP-hardness proofs. Some open questions concerning complexity status will be addressed, too.

2 - Vehicle Dispatching for New Automated Container Terminal

Ek Peng Chew, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, Singapore, isecep@nus.edu.sg, Yanhua Xu, Loo Hay Lee

In this talk, we will present a new automated container terminal (ACT) concept. The disptaching of transport vehicles in this ACT is challenging and we porpose some algorithms to provide efficient solutions for this problem.

3 - Bike-Sharing System Design and Scheduling

Mabel Chou, NUS Business School, Level 8, Biz1, Singapore, Singapore, mabelchou@nus.edu.sg, Meilin Zhang

We develop practical OR models to support decision making in the design and scheduling of public car-sharing or bicycle-sharing systems. We develop a network flow model and discuss how to design the system so that the scheduling of the re-distribution can be more cost effective.

4 - Scheduling of Non-resumable Deteriorating Jobs on a Single Machine with Multi-period Maintenances

Hui-Chih Hung, Assistant Professor, National Chiao Tung University, MB103, 1001, University Rd., Hsin-Chu, 300, Taiwan-ROC, hhc@nctu.edu.tw, Hsi-Mei Hsu, Hsun-Wen Hsu

We consider a scheduling problem of non-resumable deteriorating jobs on a single machine with multi-period maintenances. The objective is to minimize the makespan. We show that the problem with 2-period maintenances can be reformulated as a double knapsack problem and is NP-hard. A fast heuristic is proposed to find a near optimal solution subject to arbitrary relative errors. Numerical studies are implemented to verify the corresponding computational time subject to the given relative errors.

■ TD15

15- West 202- CC

Software Demonstration

Invited Session

1 - IBM ILOG CPLEX Optimization Studio

Ferenc Katai, IBM, 1681 Rue des Dolines, Les Taussiniers HB2, Valbonne 06560, France, ferenc.katai@fr.ibm.com, Ed Klotz

Come learn how the latest integrated development environment enhancements combined with engine performance improvements and new features help mathematicians, OR experts, academicians and business analysts leverage advanced analytics based on CPLEX optimization to make fact-based decisions in rapidly changing markets. A live demonstration of CPLEX Optimization Studio will be presented by experts from the largest staff of advanced analytics and optimization professionals of any company in the world.

2 - Tableau Software - Stop Wrestling with Your Data-Start Exploring it with Tableau

Jonah Kim, Tableau Software, 837 N. 34th St., #400, Seattle WA, United States of America, jbkim@tableausoftware.com

Tableau Desktop is based on breakthrough technology from Stanford University that lets you drag and drop to analyze data. You can connect to data in a few clicks, then visualize and create interactive dashboards with a few more. Tableau Software transforms stubborn databases and spreadsheets into sources for easy investigations. It's so easy to use that any Excel user can learn it. Answer questions as fast as you can think of them.

■ TD16

16- West 207- CC

Particle Filtering

Cluster: Tutorials

Invited Session

Chair: John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu

1 - Particle Filtering

John Birge, Professor, University of Chicago, Chicago, IL, United States of America, john.birge@chicagobooth.edu

Particle methods provide a robust methodology for estimation and prediction. They can also apply to traditional operations research areas by, for example, providing an effective alternative for constructing Monte Carlo simulations of various systems and for dynamic optimization. This tutorial explains the fundamental ideas behind particle methods and how to use them in typical operations research contexts.

■ TD17

17- West 208 B- CC

Operations Management, Finance Interface

Contributed Session

Chair: Thomas Yeung, Associate Professor, Ecole des Mines, 4 rue Alfred Kastler BP 20722, Nantes, 44307, France, thomas.yeung@emn.fr

1 - Inventory and Working Capital Management

Kasper van der Vliet, PhD candiate, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612 AZ, Netherlands, k.v.d.vliet@tue.nl, Matthew Reindorp, Jan Fransoo

Inventory management and working capital management are traditionally separate domains, and thus theory often neglects their interaction. We explicitly study a system where inventory can be financed by cash, reverse factoring, or borrowing. This allows us to explore the interaction between inventory policy, trade credit terms, and cash management thresholds.

2 - A Robust Portfolio Approach to System-of-Systems Network Architectures

Navindran Davendralingam, Post Doctoral Researcher, Purdue University, 701 W. Stadium Avenue, West Lafayette, United States of America, davendra@purdue.edu, Daniel DeLaurentis

This research presents a novel robust network framework to architecting a System-of-Systems (SoS). Hierarchies of interdependent systems are modeled as nodes on a network that work cohesively to fulfill overarching capability objectives. Inter-nodal performance and modes of risks associated with connectivity under varied conditions of operation are addressed within the context of a robust mean-variance investment problem. A Littoral Combat Ship (LCS) sample case demonstrates the method.

3 - Association between Automotive Recalls and Performance

Manpreet Hora, Assistant Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St. NW, Atlanta, GA, 30332, United States of America, Manpreet.Hora@mgt.gatech.edu, Nah Lee, Vinod Singhal

Studies have shown mixed results (negative or null) in investigating the impact of product recalls on the stock value of recalling firms. We collect announcements related to automotive recalls to empirically examine their association with shareholder value. We also investigate the association between different product characteristics of the vehicles recalled and shareholder value.

4 - Information Acquisition of New Technology for Maintenance and Replacement Decisions

Thomas Yeung, Associate Professor, Ecole des Mines, 4 Rue Alfred Kastler BP 20722, Nantes, 44307, France, thomas.yeung@emn.fr, Phuong Khan Nguyen Thi, Bruno Castanier

An important mission of managers is to determine the maintenance and replacement investment plan for equipment under technological evolution. The arrival time and profitability of new technology are uncertain; however information on this process may be acquired. We formulate a partially observable Markov decisions process to decide whether to obtain additional information as well as the action for the asset (wait, maintain, replace). We provide structural properties and numerical examples.

■ TD18

18- West 208 A- CC

New Developments in the PICO/PEBBL Parallel Branch and Bound Solver

Sponsor: Optimization/Computational Optimization and Software

Sponsored Session

Chair: Cynthia Phillips, Senior Scientist, Sandia National Laboratories, Mail Stop 1326, P.O. Box 5800, Albuquerque, NM, 87185-1326, United States of America, caphill@sandia.gov

1 - Applying PEBBL Parallel Branch and Bound to Protein/Peptide Docking and Maximum Monomial Agreement

Jonathan Eckstein, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu, Cynthia Phillips, William E. Hart

We discuss applying the PEBBL parallel branch-and-bound library to a quadratic semi-assignment approximation of the protein-peptide docking problem, with a strengthened bounding procedure having the same complexity as prior bounds. This application exhibits strongly and reproducibly superlinear speedups definitively attributed to processor cache behavior. We also describe applying PEBBL to maximum monomial agreement, an problem arising from machine learning.

2 - Computing Certificates for Integer Programs

Ojas Parekh, Senior Member Technical Staff, Sandia National Laboratories, MS 1326, Albuquerque, NM, 87185, United States of America, odparek@sandia.gov, Cynthia Phillips, Robert Carr, Harvey Greenberg

A certificate for a computation is data that allows an independent program to verify that its output is correct. A canonical example is the primal/dual certificate for a linear program, requiring only two matrix evaluations to prove the optimality of any solution. A certificate for an IP branch-and-bound computation must prove that each branching operation, added cut, and fathoming operation is correct. We will discuss what this entails in the context of PICO, our massively parallel IP solver.

3 - PICO's New Hierarchical Branch-and-bound System for Massively Parallel IP

Cynthia Phillips, Senior Scientist, Sandia National Laboratories, Mail Stop 1326, P.O. Box 5800, Albuquerque, NM, 87185-1326, United States of America, caphill@sandia.gov, Jonathan Eckstein, Ojas Parekh, John D. Siirola, Jean-Paul Watson

We present the design, implementation, and large-scale parallel computational results for a new capability in the PICO (Parallel Integer and Combinatorial Optimizer) massively-parallel mixed-integer programming (IP) solver. We leverage the PICO ramp up system for automatic IP decomposition and carefully manage runtime conditions to effectively run arbitrary black-box IP solvers on massively parallel systems. Our computational results use a Sandia National Laboratories' 20,000-core system.

■ TD19

19- West 211 A- CC

Resource Management in Health Care

Contributed Session

Chair: Mihiro Sasaki, Prof., Nanzan University, 27 Seirei, Seto, 489-0863, Japan, mihiro@nanzan-u.ac.jp

1 - Integral Resource Capacity Planning for Inpatient Care Services

Aleida Braaksma, Academic Medical Center Amsterdam & University of Twente, Drienerlolaan 5, Enschede, 7500 AE, Netherlands, A.Braaksma@utwente.nl, Nikky Kortbeek, Ferry Smeenk, Richard J. Boucherie, Piet J.M. Bakker

The challenge in decision making for inpatient care delivery is to guarantee care from appropriately skilled nurses and required equipment for patients, while making efficient use of resources. We present a stochastic analytical approach to predict bed census on nursing wards by hour, as a function of the Master Surgical Schedule and arrival patterns of emergency patients. Based on the hourly census predictions, flexible nurse staffing methods are proposed.

2 - Using On-call Providers for Emergency Departments

Subhamoy Ganguly, Leeds School of Business, University of Colorado at Boulder, Boulder, United States of America, Subhamoy.Ganguly@Colorado.EDU, Stephen Lawrence, Mark Prather

Medical emergency departments (EDs) face stochastic demand in terms of patient arrivals and their acuity levels. To meet high service-levels while keeping staffing costs under control, EDs often have providers on call, who are summoned to handle any unforeseen surge in demand. Using empirical data collected from three active EDs, we analyze how on-call providers can be effectively used in conjunction with a base staffing schedule to deliver high service-level with minimal staffing costs.

3 - A Decision Support System for Case Mix and Capacity Planning at Jessa Hospital

Guoxuan Ma, Faculty of Business and Economics, KU Leuven, Naamsestraat 69, Leuven, B-3000, Belgium, guoxuan.ma@econ.kuleuven.be, Erik Demeulemeester

This paper presents a decision support system for hospital case mix and capacity planning and describes the results of an application in a Belgian hospital. The case mix and capacity planning concerns both the long-term decision on patient volume and mix and the medium-term decision on resource allocation. The objective is to advance the trade-offs between efficiency and service. For this purpose, a model-based integrative methodology is developed on the basis of operational research techniques.

4 - Optmization Approach to Dispatch EMS Vehicles
Farshad Majzoubi, University of Louisville, 775 Theodore Burnett Ct Apt4, Louisville, KY, 40217, United States of America, f0majz01@louisville.edu, Lihui Bai, PhD., Sunderesh Heragu

The research considers the problem of dispatching ambulances when the demand for ambulance is high. Two scenarios are considered: 1- Dispatcher can determine the hospital, 2- Patients determine the hospital. For the first scenario, the mathematical model using general software optimizers is shown to be useful , but, for the second scenario, mathematical model is not solved in a reasonable time, hence, some heuristic methods are developed to be used in real situations.

5 - Resource Allocation Planning for High Quality Healthcare Services in a Super-aged Society
Mihiro Sasaki, Prof., Nanzan University, 27 Seirei, Seto, 489-0863, Japan, mihiro@nanzan-u.ac.jp, Takamori Ukai, Masanori Hara, Shigeaki Inoue

Due to coming super-aged society in Japan, the distribution of patients affected by acute and chronic disease has been changed drastically. Since the current healthcare system was designed in several decades ago without taking account of facing aged-society, many of medical staff are concerned about collapse of the healthcare system in the near future. We are trying to reallocate resources to improve the quality of healthcare services using operations research technique.

■ TD20

20- West 211 B- CC

Health Care Treatment and Therapy

Contributed Session

Chair: Richard Hughes, Associate Professor, University of Michigan, 2003 BSRB, 109 Zina Pitcher Pl, Ann Arbor, MI, 48109, United States of America, rehughes@umich.edu

1 - Administrative Barriers to Opening Clinical Trials
Diego Martinez, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, dmartinezcea@mail.usf.edu, Kimberlea Hauser, Benjamin Djulbegovic, Athanasios Tsalatsanis, Ali Yalcin

There are many challenges associated with opening a clinical trial in a university setting such as trial design, administrative procedures and approvals, patient and physician accrual. The proposed research explores and evaluates the administrative procedures required for opening a clinical trial at the University of South Florida.

2 - Optimal Control for Predicting Drug Dosage in Superovulation Stage of in Vitro Fertilization
Urmila Diwekar, President, Vishwamitra Research Institute, 368 56th Street, Clarendon Hills, IL, 60514, United States of America, urmila@vri-custom.org, Kirti Yenkie

Superovulation is the most crucial stage in In Vitro Fertilization (IVF), since it involves external injection of hormones to stimulate development and maturation of multiple eggs. This paper presents a physics based model for superovulation validated with patient data and used to predict drug dosage based on optimal control theory.

3 - An Effective Methodology for Predicting the Severity of Prostate Cancer Based on Biopsy Results
Arthur Swersey, Professor of Operations Research, Yale School of Management, Box 208200, New Haven, Ct, 06520, United States of America, arthur.swersey@yale.edu, Johannes Ledolter, Rodney Parker

The effectiveness of PSA screening for prostate cancer is a hotly debated topic with all sides agreeing that overtreatment is a major problem. We develop a simulation model of the prostate biopsy procedure and use probability modeling to devise an effective decision rule for deciding whether to treat, based on the amount of cancer found on biopsy. This rule results in a high rate of detection and treatment of important tumors, while minimizing the treatment of insignificant ones.

4 - Treatment Selection Strategy for Long-Term Management of Follicular Lymphoma
Larry White, Associate Professor, Eastern Illinois University, School of Business, 600 Lincoln Avenue, Charleston, IL, 61920, United States of America, lrwhite2@eiu.edu

Healthcare providers and patients have numerous options for treatment of follicular lymphoma, an incurable indolent cancer. We investigate factors affecting treatment selection including expected benefits to survival, quality of life, time to next treatment; expected costs including out-of-pocket expenses, third-party payments, time off work; provider capabilities; and expected research advancements. We derive appropriate treatment strategies for a variety of scenarios and objectives.

5 - A Stochastic Structural Reliability Model Explains Rotator Cuff Repair Re-tears
Richard Hughes, Associate Professor, University of Michigan, 2003 BSRB, 109 Zina Pitcher Pl, Ann Arbor, MI, 48109, United States of America, rehughes@umich.edu, James Carpenter, Drew Donnell, Christopher Mendias, Jessica Seidelman, Bruce Miller

Re-tear of surgically repaired rotator cuff tears is common. We developed a two-state time-inhomogeneous Markov model to predict survival of repaired full-thickness rotator cuff tears. The probability of re-tear at each time step was modeled using a probabilistic structural reliability model. Model predictions were compared to the clinical results of our (J.E.C. and B.S.M.) patients. The model predicted 2-year survival within the 95% confidence interval of the Kaplan-Meier estimate (75.7%).

■ TD21

21- West 212 A- CC

Decomposition Approaches for Solving Network Optimization Problems

Sponsor: Optimization/Networks

Sponsored Session

Chair: Jose L. Walteros, University of Florida, 303 Weil Hall, Gainesville, FL, 32611-659, United States of America, jwalteros@ufl.edu

1 - A Branch-and-Price Approach for Solving the Critical Clique Detection Problem
Jose L. Walteros, University of Florida, 303 Weil Hall, Gainesville, FL, 32611-659, United States of America, jwalteros@ufl.edu, Panos Pardalos

The problem of detecting critical elements in a graph involves identifying a subset of elements whose deletion minimizes a connectivity measure of the induced subgraph. In this work we examine the problem of detecting critical cliques. We introduce two (0, 1)-linear formulations that are solved via branch-and-price. We present computational experiments comparing our results to competing formulations, as well as directions to modify our approach to tackle other critical element detection problems.

2 - Benders Decomposition for a Strategic Network Design Problem under NAFTA Local Content Requirements
Katharina Mariel, Daimler AG, Mercedesstrafle 137, E 203, Stuttgart, 70546, Germany, katharina.mariel@daimler.com, Stefan Minner

Free Trade Agreements strongly influence global production and sourcing strategies of multinational corporations. Based on local content requirements of the North American Free Trade Agreement (NAFTA) for automotive goods, a mixed integer, non-linear model is presented and solved by Benders Decomposition. Numerical results illustrate the capability of the algorithm and give some insights into election to average rules.

3 - A Complimentary Column Generation Approach for a Complete Graph Partitioning Problem
Salem Al-Yakoob, Assocsiate Prof, Kuwait University, Kuwait, Kuwait, salem@al-yakoob.com

We will present two mathematical programming formulations and a complimentary column generation approach for the problem of partitioning a complete weighted graph into complete subgraphs having the same number of vertices with the objective of minimizing the total edge weights of the resulting subgraphs. Computational results will be presented and analyzed using a wide range of test problems.

4 - A Column Generation Framework for Routing Problems with Time Windows
Leonardo Lozano, Instructor, Universidad de los Andes, Departamento de Ingenieria Industrial, Carrera 1 Este # 19 A-40, Bogota, Colombia, leo-loza@uniandes.edu.co, Andrès L. Medaglia

Routing problems with time windows are well known NP-Hard problems. New variants emerge in various contexts (e.g., home care) posing new challenges and including different side constraints. We propose a column generation framework that can be embedded into exact approaches or matheuristics. The novelty lies in the specialized network algorithm proposed for the pricing problem. Our framework can be extended to several routing problems like the dial-a-ride or the VRPTW with pick-up and delivery.

■ TD22

22- West 212 B- CC

Branching in Mixed-Integer Programming II

Sponsor: Computing Society

Sponsored Session

Chair: John Chinneck, Carleton University, Systems and Computer Engineering, Ottawa, On, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - A Wide Branching Strategy for Branch-and-Price Algorithms

David Morrison, University of Illinois, Urbana-Champaign, Siebel Center, Department of Computer Science, 201 N. Goodwin Ave., Urbana, IL, 61821, United States of America, morris50@illinois.edu, Sheldon Jacobson, Jason Sauppe, Edward Sewell

The usual branching strategy for branch-and-price algorithms forces a single variable to either 0 or 1 and attempts to preserve the pricing problem structure. When this structure cannot be preserved, a wide branching strategy, which branches on all available variables and assigns them value 1, can be used. This strategy uses delayed branching techniques to limit the search tree width to a manageable size, and is competitive with the best-known solvers for graph coloring problems.

2 - Branching in SCIP

Gerald Gamrath, Research Assistant, Zuse-Institut Berlin, Takustr 7, Berlin, 14199, Germany, gamrath@zib.de

Deciding how to branch is one of the most important decisions any branch-and-bound based MIP solver has to take. In this talk, we discuss the so-called "hybrid branching" scheme, which combines the well-known concepts of strong-branching and pseudo-costs with more general criteria like conflicts and inferences originating from the SAT and CP context. Regarding a current example, we discuss drawbacks of current methods and present recent experiments concerning an extended strong branching.

3 - Using Lattice Basis Reduction to Compute General Disjunctions in Practice

Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States of America, mehrotra@iems.northwestern.edu, Kuo-Ling Huang

We will present results from a practical implementation of general disjunction algorithm using the Mehrotra and Li approach for solving general mixed integer convex programs. This method uses log-barrier ellipsoidal approximation for the continuous relaxation and performs Lenstra-Lenstra-Lovaz lattice basis reduction methods as a core to find a good branching direction. Computational results show significant difference in branch-and-bound nodes in many problems.

4 - Parallel Approach to Information-based Tree Search

Rodolfo Carvajal, Georgia Institute of Technology, 755 Ferst Drive NW, Atlanta, GA, 30332, United States of America, rocarvaj@gatech.edu, George Nemhauser, Shabbir Ahmed

To reduce the number of nodes searched in branch-and-bound algorithms, KilinÁ-Karzan et al. (2009) proposed a branching scheme that collects information during the search and uses it in a restart phase. We implement variants of this approach that exploit parallelism in the collection or use of information and report computational results.

■ TD23

23- West 212 C- CC

Joint Session Analytics/CPMS: Reprise 2011 Innovation in Analytics Finalists and Award Winner

Sponsor: Analytics & CPMS, The Practice Section

Sponsored Session

Chair: Michael Gorman, University of Dayton, Dayton, OH, United States of America, michael.gorman@udayton.edu

1 - Service Delivery Modeling and Optimization

Yixin Diao, IBM, Yorktown Heights, NY, United States of America, diao@us.ibm.com, Aliza R. Heching, David Northcutt

This project addresses the problem of identifying optimal staffing (staffing levels, shifts, and skills) for IBM's globally located IT service delivery teams. Over the past three years, the project team has defined, developed, and deployed complex simulation models across multiple service line disciplines. These models have been deployed on a massive scale across the global scope of the IBM delivery organization. This has resulted in improved resource usage, delivery efficiency, and service quality over a large number of service delivery teams.

2 - Managing Immigration and Customs Enforcement's Program Operations with Innovative Analytics

Cenk Tunasar, Booz Allen Hamilton, McLean, VA, 22101, United States of America, tunasar_cenk@bah.com, Nicholas Nahas, Patrick McCreesh, Jeffrey Munns, Govind Nagubandi

Since 2009, Booz Allen has supported Immigration and Customs Enforcement (ICE) Law Enforcement Systems and Analysis (LESA) unit's effort to increase criminal alien removals with descriptive, predictive, and prescriptive analytics. These analytics are used to quantify resource needs; assess performance against objectives; and determine strategic direction. Five models-The Strategic Decision Model (SDM), Operational Workforce Analysis, Criminal Alien Population Model, Deployment Optimization Model, and the Network Optimization Mode- are used for this innovative analytics support. The innovation is in the integration of models, the out-come centered approach, and how these models deliver traditional industrial engineering solutions to creatively solve a public sector challenge of immigration enforcement. Over the last three years, Booz Allen has changed the way that ICE talks about, and thinks about, performance. Booz Allen has shaped the thinking of ICE's senior leadership and supported the development of an agency-wide, quantitatively-driven strategy to identify and remove criminal aliens from the U.S. effectively and efficiently. The agency looks for opportunities to "optimize" rather than just seek incremental improvements. The evolution in mindset is one strong impact of the analytics support at ICE.

■ TD24

24- West 213 A- CC

Stochastic Models for Medical Decision Making

Sponsor: Health Applications Society

Sponsored Session

Chair: Yuanhui Zhang, PhD Student, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, yzhang29@ncsu.edu

1 - Iterative Characterization of Stable Equilibria for the Timing of Paired Kidney Exchanges

Murat Kurt, Assistant Professor, University at Buffalo, SUNY, University at Buffalo, North Campus, 415 Bell Hall, Buffalo, NY, 14260, United States of America, muratkur@buffalo.edu, Utku Unver, Mark Roberts, Andrew Schaefer

Paired kidney exchanges (PKE), overcomes many difficulties in matching patients with incompatible donors. We consider a stochastic game formulation to model the transplant timing decisions in a two-way prearranged PKE. For large scale problems, we develop a convergent iterative algorithm to characterize a stable equilibrium of the game. We use clinical data to illustrate computational efficiency of the algorithm to equilibrium characterization through MILP and compare policy outcomes.

2 - Personalized Biopsy Referral Decision Modeling in the Presence of Breast Cancer Regression

Fan Wang, University of Arkansas, Department of Industrial Engineering, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, fxw005@uark.edu, Shengfan Zhang, Kathleen Diehl

Mammography, the current standard modality for breast cancer screening, is not perfect. Biopsy is often performed to verify the presence of cancer after positive results. We developed a discrete time finite-horizon Markov decision process model to optimize biopsy referral policies based on total expected quality-adjusted life years. The model incorporates individual's breast cancer risk factors and mammogram screening history and allows the possibility of spontaneous disease regression.

3 - Modeling to Inform Proactive Management of Inpatient Care

Muge Capan, North Carolina State University, 400 Daniels Hall; College of Engineering, Raleigh, NC, 27695, United States of America, mcapan@ncsu.edu, Julie S. Ivy

Improving inpatient care is an emerging focus in hospitalist systems. By considering patients' frailty and vital signs, patient profiling provides a method for predicting deterioration in patient health. We propose to develop an optimization model based on sequential health data to create proactive health measures and support individualized rescue interventions.

4 - Coordination of the Influenza Vaccine Supply Chain with Effort

Xinghao Yan, Richard Ivey School of Business, 1151 Richmond St. N, London, ON, Canada, xyan@ivey.uwo.ca, Greg Zaric

We study the influenza supply chain consisting of the health authority, the vaccine manufacturer, and the population. The health authority can make efforts to increase the vaccination rate from the population. We compare the decisions and the social welfare (number of infections) in the decentralized case and those in the centralized case. Finally, we investigate coordination contracts for the influenza supply chain with the health authority's effort.

■ TD25

25- West 213 B- CC

New Healthcare

Sponsor: Health Applications Society

Sponsored Session

Chair: Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 10, Stanford, CA, 94305, United States of America, y7ding@stanford.edu

1 - Efficiency of Subsidy Schemes in Reducing Waiting Times for Public Health Services

Qu (Alex) Qian, Assistant Professor, Shanghai University of Finance and Economics, 777 Guoding Road, School of International Business Adm, Shanghai, 200433, China, qian.qu@mail.shufe.edu.cn, Pengfei Guo

This paper studies the efficiency of two typical subsidy schemes used in health care systems: unconditional and conditional. For each subsidy scheme we consider two information scenarios, no and full, that represent situations in which customers observe no realtime delay information and workload, respectively. We find that preferences for the two subsidy schemes depend on the information scenario and the size of the public fund.

2 - Improving Healthcare Delivery to Traveling Patients in the Veterans Health Administration

Erkan Ceyhan, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, MA, 02139, United States of America, eceyhan@mit.edu, Shahed Al-Haque

Performed in collaboration with the VHA, this research investigates the improvement of healthcare delivery to traveling patients. After analysis of the current state, the study aims to provide operations management strategies, through simulation of potential policy interventions, that enable more effective and efficient resource allocation to meet traveling patients' needs.

3 - Controlling Healthcare Queues

Sara Nourazari, Northeastern University, 334 Snell Eng. Center, 360 Huntington Ave., Boston, MA, 02115, United States of America, sara@coe.neu.edu, James Benneyan, Rifat Siphai

Queuing problems abound in almost all service systems. Typical analysis or design approaches are to statically determine service capacity to achieve acceptable mean performance levels, such as mean number or time in queue, resulting in periods of poor service spikes and unattractive utilization-service-cost tradeoffs. We explore the use of control theory to adapt service capacities in healthcare systems to achieve desired mean and threshold performance levels under a variety of assumptions.

4 - Modeling Patient Follow-ups in a Primary Care Clinic

Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 10, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Chinghua Chen, Mayank Sharma

In an outpatient setting, patients arriving for a single appointment may unexpectedly find that they must return for one or more follow-up appointments. This paper develops a Markov decision process (MDP) to model this phenomenon when the regular patients have to book their visits in advance. We derive an approximately optimal policy to this MDP and evaluate its performance by simulations.

■ TD26

26- North 221 A- CC

Customer Queuing Behaviors and Their Implications for M&SOM

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Mirko Kremer, Pennsylvania State University, State College, PA, United States of America, muk22@smeal.psu.edu

1 - Expert Queues: Information Pricing and Congestion

Senthil Veeraraghavan, Associate Professor, The Wharton School, 3730 Walnut Street Suite 550, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Mehmet Fazil Pac

Consumers cannot identify their problems often (for e.g. car repair). Therefore they rely on experts, who also provide the service, for the diagnosis of their problems. The information asymmetry arising upon diagnosis leads to inefficiencies in service provision. The expert has an incentive to over-provide or to ration services, based on the demand, capacity and the consumer waiting costs. We investigate diagnosis and pricing decisions in expert service markets using a queuing framework.

2 - Visible Queues: Customer Response to Waiting at Gas Stations

Margaret Pierson, Assistant Professor, Tuck at Dartmouth, Hanover, NH, United States of America, mpierson@hbs.edu

Empirical study of consumer choice in gasoline market using pricing data and queue inference from observations of service time. Two year panel data study, with observations of all transactions, at 15 retail outlets in Massachusetts. Queue inference is augmented by study of video footage from the gasoline retailer. Anecdotal observations of customer behavior observed in the footage will also be presented.

3 - Service Systems with Anecdotal Reasoning Consumers

Ying-Ju Chen, UC Berkeley, Berkeley, United States of America, chen@ieor.berkeley.edu, Yimin Yu, Tingliang Huang

We study service systems where consumers have boundedly rational expectations. In particular, we assume that consumers lack full capability or ample opportunity to perfectly infer the waiting time, and thus can only rely on past experiences and anecdotal reasoning to make their joining or balking decisions.

4 - Learning Quality from Queues: A Laboratory Experiment

Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu, Mirko Kremer

In this talk, I will report the results of a laboratory experiments in which human subjects need to decide whether to join the queue or not, when the quality of the service is unknown to the subject, but known to a small fraction of the population.

■ TD27

27- North 221 B- CC

Topics in Service Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Ramandeep Randhawa, University of Southern California, Los Angeles, United States of America, ramandeep.randhawa@marshall.usc.edu

1 - Vendor Selection, Contract Efficiency and Performance Measurement in Service Outsourcing

Sameer Hasija, INSEAD, Fontainbleau, France, sameer.hasija@insead.edu, Zhijian Cui

This study compares the efficacy of some commonly observed vendor selection and contracting mechanisms with respect to two key challenges in service outsourcing: vendor selection and contract efficiency. We show that competitive bidding yields good selection but contract inefficiency. In contrast, if the client establishes the contract terms then the "menu" it designs yields contract efficiency but poor selection.

2 - Contracting and the Dynamics of Collaboration in Service Processes

Morvarid Rahmani, PhD Candidate, UCLA, 110 Westwood Plaza, Los Angeles, 90095, United States of America, morvarid.rahmani.2013@anderson.ucla.edu, Guillaume Roels, Uday Karmarkar

Collaboration governs many work processes; for example, it is common in business-to-business services. In this paper, we study when collaboration takes place in a joint project, and how the dynamics of collaboration are aected by the project deadline, the veriability of efforts, and the type of contract adopted by the parties involved in the project.

3 - Groupon for Services: Is it a Good Deal?

Guangwen Kong, University of Southern California, Marshall School of Business, Los Angeles, United States of America, guangwen.kong.2013@marshall.usc.edu, Ramandeep Randhawa

Online social advertising tools such as Groupon generate new business for service providers and at the same time generate new challenges. Discount-seeking customers may impose externalities on the system that could drive away regular customers. We analyze these tradeoffs and devise recommendations as to when would Groupon promotions be beneficial.

4 - Setting Quality and Speed in Service Industry with Repeated Customers

Azin Farzan, Student, University of Washington, Box 353226, Foster Business School, Univ. of Wa., Seattle, WA, 98195, United States of America, afarzan@uw.edu, Yong-Pin Zhou

We analyze a system in which customers purchase services repeatedly. Customers benefit from a higher quality level and incur cost due to waiting. Customers choose to join the service based on the expected value of the service. After each encounter, they repeat the purchase depending on the quality perceived. The firm invests in capacity and quality levels jointly. We analyze these decisions and their relationship. We also consider the duopoly scenario and analyze the equilibria in each setting.

■ TD28

28- North 221 C- CC

Sustainability in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fountainbleau, 77305, France, Serguei.Netessine@insead.edu

1 - Dynamics of Sustainable Business Relationship

Pavel Izhutov, PhD Student, Stanford University, 655 Knight Way, Stanford Graduate School of Business, Stanford, CA, 94305, United States of America, IZHUTOV@stanford.edu, Hau L. Lee

A retailer is interested in designing a contract that ensures the use of responsible production process by the supplier. The key features of the examined contract are its duration and continuation/termination conditions. The optimal contract ensuring responsible supplier behavior is derived.

2 - Electric Vehicles with a Battery Switching Station: Adoption and Environmental Impact

Buket Avci, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, buket.avci@insead.edu, Serguei Netessine, Karan Girotra

We analyze a novel switching-station based business model for the deployment of electric vehicles. We develop a stylized analytical model that captures the salient features of EV adoption decision by modeling range anxiety and the impact of different ownership structures (selling miles vs. selling batteries). We find that electric vehicles with switching stations can incent adoption and reduce oil dependence but, paradoxically, this increased adoption may not necessarily benefit the environment.

3 - Delivering the Sustainable Way

Gerard Cachon, University of Pennsylvania, 3730 Walnut Street, Philadelphia, United States of America, cachon@wharton.upenn.edu

People need to have goods brought to their homes. They can do this themselves - drive to a store, purchase a basket of items and then return back home. Or, they can order on-line and have the goods delivered to their doorstep. With a view to sustainability, which of those approaches is better?

4 - Strategic Investment in Renewable Energy Sources

Sam Aflaki, HEC, France, aflaki@hec.fr, Serguei Netessine

We model the tradeoff between investing in an intermittent renewable technology (such as wind) and a reliable non-renewable technology (such as natural gas). Motivated by existing electricity markets, we analyze the effectiveness of carbon pricing strategies to promote renewables in several interrelated contexts including: (a) vertically integrated supplier, (b) market competition and (c) long-term fixed-price contracts for renewable electricity.

■ TD29

29- North 222 A- CC

Joint Session MSOM/SPPSN: Emergency Medical Services (EMS) Operations

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG & Public Programs, Service and Needs

Sponsored Session

Chair: Alex Mills, Indiana University Kelley School of Business, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, millsaf@indiana.edu

1 - Scheduling and Routing Ambulances that Provide Inter-facility Patient Transfers

Laleh Haerien, University of Alberta, School of Business, Edmonton, AB, T6G 2R6, Canada, haerian@gmail.com, Dan Haight, Armann Ingolfsson, Angela Kercher, Mohamed Salama, Matt Stanton

In Edmonton and Calgary, Canada, a specialized ambulance fleet transfers patients between hospitals. We use a VRP heuristic to schedule transfers that are known a day in advance, and a similar heuristic to accommodate emergent transfers in real time. Simulation experiments comparing the performance of this approach to historical schedules suggests that improvements on all performance metrics that we investigated are possible, ranging from 60% (for lateness) to 6% (for deadhead travel).

2 - Optimizing the Deployment of Public Access Defibrillators

Derya Demirtas, University of Toronto, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, demirtas@mie.utoronto.ca, Roy Kwon, Timothy Chan

Sudden cardiac arrest is a major public health problem. The treatment for cardiac arrest is very time-sensitive. Deploying automated external defibrillators (AEDs) in public areas for bystander use reduces the time to defibrillation and improves survival rates. In this talk, we present optimization models to guide the deployment of AEDs in public settings. Computational results using real cardiac arrest and AED data from Toronto, Canada demonstrate the effectiveness of the proposed models.

3 - A Model for Optimally Transporting Emergency Medical Service Patients to Hospitals

Benjamin Grannan, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23284, United States of America, grannanbc@mymail.vcu.edu, Laura McLay

We present a Markov decision process model for determining how to optimally dispatch ambulances to patients and then transport patients to distinguishable receiving locations (hospitals). Through this model, we investigate how the revelation of information about a patient over time affects the interrelated dispatch and transport decisions. Particular attention is paid on the impact of initial customer classification errors. The optimal policy is compared to two myopic policies.

4 - Resource Allocation in Mass Casualty Incidents

Alex Mills, Indiana University Kelley School of Business, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, millsaf@indiana.edu, Serhan Ziya, Nilay Argon

When multiple mass-casualty incidents compete for limited resources, such as ambulances, emergency planners must decide both how to allocate resources and how to prioritize different classes of patients. Widely used triage protocols, such as START, do not describe how to handle these decisions. We develop centralized and decentralized prioritization policies that can be effective in such a scenario.

■ TD30

30- North 222 B- CC

Facilities Planning and Design

Contributed Session

Chair: Venkat Rohit Kota, PhD. Candidate, Grado Department of Industrial and Systems Engineering (0118) Virginia Polytechnic Institute and State University, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, krohit@vt.edu

1 - Facility Layout: Optimization and Simulation Approach

Phong Ho, Professor, HCM City International University, KP6, Linh Trung, Thu Duc, Ho Chi Minh City, Vietnam, htphong@hcmiu.edu.vn, Huy Truong, Quoc Ho

This research integrates multi-objective optimization and simulation to solve a factory layout problem where a new objective, reachability, has been added. Reachability is defined as the ability of one facility to reach an alternative facility when the default facility is down. Genetic Algorithms is integrated in simulation to evaluate solutions. A numerical example is presented to demonstrate the effectiveness of the proposed solution.

2 - Solving a Facility Layout Problem for a Manufacturer Applying a Meta-Heuristic and Lean Objectives

Ahmed Abdulaal, M.S. Candidate, University of New Haven, 300 Boston Post Rd, West Haven, CT, 06516, United States of America, aabdu3@unh.newhaven.edu, Amy Thompson

This research presents a facility layout case study that finds an improved facility layout for a manufacturer based upon a set of lean objectives that include safety, quality, flow, and efficiency. Through development of a new meta-heuristic, a significantly better solution was found demonstrating a real-world application to a large-scale problem. The model allocated 43 machines to a 23,000 square foot production floor in minutes, reduced flow cost by 40%, and freed significant floor space.

3 - Analytical and Heuristic Based Results for Puzzle-Based Warehouse Systems

Venkat Rohit Kota, PhD. Candidate, Grado Department of Industrial and Systems Engineering (0118) Virginia Polytechnic Institute and State University, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, krohit@vt.edu, Gaylon Don Taylor

One manifestation of very high density storage systems is the 'puzzle-based' system, in which unit loads move through the system by changing the location of empty escorts to retrieve demanded items. In this research, the authors investigate retrieval times for scenarios when the number of empty locations are two or more. Closed form solutions, and heuristic based approaches are proposed to aid retrieval strategies.

4 - The Model Development of Plant Productivity Improvement in Steel Factory

Mohammad A. Quasem, Department of Information & Decision Sciences, Washington, DC, United States of America, mohammadquasem@gmail.com, M.H. Shwehdi

The Reliable distribution of electric power has been plagued by common problems such as interruption, voltage sags, and swells, as well as voltage flicker, and transients. The impact of these problems has gotten worse in recent years due to the nature of the loads that are served by the power system. This paper will present the different power quality problems encountered by some of the plants. The study suggests and recommends solutions to increase savings and reduce power quality problems and therefore plant productivity.

■ TD31

31- North 222 C- CC

Empirical Research in Service Operations

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Marcelo Olivares, Columbia Business School, 3022 Broadway, Uris Hall 417, New York, NY, 10027, United States of America, molivares@columbia.edu

1 - Learning from Customers: Individual and Organizational Effects

Bradley Staats, Assistant Professor, University of North Carolina-Chapel Hill, McColl Building, CB 3490, Chapel Hill, NC, 27599, United States of America, Bradley_Staats@kenan-flagler.unc.edu

We explore the customer dimension of volume-based learning in a radiological setting, where individual doctors at an outsourcing firm complete radiological reads for hospital customers. We examine more than 2.7 million cases for 1,431 customers read by 97 radiologists and find evidence supporting the benefit of accumulating customer-specific experience. We discuss the implications of our results for the study of learning as well as for the providers and consumers of outsourced services.

2 - Reputation in Online Service Marketplaces

Antonio Moreno-Garcia, Kellogg School of Management, 2001 Sheridan Road, Evanston, 60208, United States of America, a-morenogarcia@kellogg.northwestern.edu, Christian Terwiesch

Online service marketplaces allow service buyers to post their projects and service providers to bid for them. In order to reduce the transactional risks, previous seller performance is usually reflected in a numerical reputation score. By analyzing a detailed dataset with more than 1,800,000 bids corresponding to 270,000 projects posted between 2001 and 2010 in a leading on-line intermediary for software development services, we empirically study the effects of reputation on market outcomes.

3 - Data Analysis of Service Times in Call Centers

Noah Gans, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States of America, gans@wharton.upenn.edu, Han Ye, Haipeng Shen

We have been analyzing large datasets from telephone call centers to better characterize pervasive but little-studied phenomena that affect their operations. In this talk, we'll discuss agent call times, which show considerable heterogeneity and evolve according to somewhat predictable patterns.

4 - Empirical Study on Agent Productivity in IT Service

Yina Lu, Columbia Business School, 3022 Broadway, 423 Uris Hall, New York, NY, 10027, ylu13@gsb.columbia.edu, Aliza R. Heching, Marcelo Olivares

We analyze a new dataset from a leading IT company that captures how agents spend their time and switch among tasks. We find that agent productivity is a time-dependent metric as opposed to be static and intrinsic to an agent. We thus propose the use of hazard rate to measure productivity and explore the driving factors that affect it, including interruptions, unfinished workload and cumulative workload during a shift. Our findings can help to develop more intelligent task routing scheme.

■ TD32

32- North 223- CC

Supply Chain Risk and Information

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Zhibin (Ben) Yang, Assistant Professor, University of Oregon, 1208 University of Oregon, Eugene, 97403, United States of America, zyang@uoregon.edu

1 - Information Asymmetry with the Presence of Spot Market

Xuan Zhao, Associate Professor, Wilfrid Laurier University, 75 University Ave.W., Waterloo, ON, N2J4Y8, Canada, xzhao@wlu.ca, Wei Xing

This paper studies the effect of information asymmetries (in both demand and the spot price) on the members of a two-stage supply chain in the presence of spot market. Using a novel method to obtain the posterior bivariate normal distributions, we model the information updating Stackelberg game and derive the unique equilibrium strategies. We then explore when the supplier intends to use a forward contract, whether a better demand/spot price forecast always preferred.

2 - Are Responsive Pricing and Supply Diversification Substitutes in Hedging Supply Uncertainty?

Tao Li, UT Dallas, 800 W Campbell Road, Richardson, TX, 75080, United States of America, tao.li@utdallas.edu, Suresh Sethi, Jun Zhang

Responsive pricing and supply diversification are two strategies that firms adopted to mitigate supply uncertainty. It seems intuitive that they are substitutes in hedging supply uncertainty. We find that they are actually complements under certain conditions. Specifically, when the cost of lost goodwill is low and suppliers' costs are medium, the firm's diversification propensity is higher and it can gain higher value of diversification with responsive pricing than without.

3 - Coordination in a Multi-retailer Distribution System: Supplier-facilitated Transshipments

Rong Li, SMU, 50 Stamford Road, Singapore, Singapore, rongli@smu.edu.sg, Zhi Zeng, Jennifer Ryan

We study a two-period production and inventory distribution problem in which transshipments, reactive and proactive, among independent retailers occur in the second period. We propose and examine a new coordination scheme: supplier-facilitated transshipments, implemented via a bi-directional adjustment contract, offered by the supplier to each retailer. We show that coordination can be achieved; a unique state-dependent adjustment (or transshipment) price must be used for coordination.

4 - Timing and Signaling Considerations for Recovery from Supply Chain Disruption

Zhibin (Ben) Yang, Assistant Professor, University of Oregon, 1208 University of Oregon, Eugene, 97403, United States of America, zyang@uoregon.edu, Nagesh Murthy

We study a supplier's timing decisions for recovery from a disruption, when the buyer trades off backup option and waiting for supply recovery. The supplier quotes a due date for recovery, and can accelerate supply recovery by increasing effort. We find the supplier strategically quotes an early due date for retaining the buyer, leading to Pareto-improvement of the channel. When the supplier is privately informed about disruption severity, the due date serves as a signal of disruption severity.

■ TD33

33- North 224 A- CC

Inventory Allocation and Pooling

Contributed Session

Chair: S Viswanathan, Professor, Nanyang Technological University, College of Business, Nanyang Avenue, Singapore, 639798, Singapore, asviswa@ntu.edu.sg

1 - A Continuous Review Inventory System with Two Types of Customers

Sapna Isotupa, Associate Professor, Wilfrid Laurier University, School of Business and Economics, Wilfrid Laurier University, Waterloo, ON, N2L 3C5, Canada, sisotupa@wlu.ca

In this paper a lost sales (S-1, S) inventory system with two types of customers – high priority and low priority is analyzed. The central objective is to determine at what inventory levels should low priority customers be turned away to prevent stock outs for the high priority customers.

2 - Inventory Allocation Methods and Service Level Agreements
Chun-Miin Chen, Pennsylvania State University, 430 Business Building, University Park, PA, 16802, United States of America, cxc732@psu.edu, Doug Thomas

Firms may employ a variety of methods to allocate scarce supply to meet multiple customer demands. We examine the impact to customer service levels of different allocation methods both analytically and computationally. We find substantial differences in customer service performance across different allocation rules.

3 - Cost Reductions by Pooling of Inventory
Alexandra van Wijk, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, A.C.C.v.Wijk@gmail.com, Ivo Adan, Geert-Jan van Houtum

Downtime of machines is an expensive cost factor for many companies. For this reason, spare parts are kept on stock, to be able to quickly respond to breakdowns. We study spare parts inventory models, allowing for stock transfers between the local warehouses, so-called lateral transshipments. In this way, we create pooling of inventory. We investigate when lateral transshipments lead to cost reductions, how these can be optimally applied, and when simple, easy to implement policy are optimal.

4 - Advance Demand Information and Early Fulfillment in Inventory Systems with Two Demand Classes
Sourish Sarkar, Assistant Professor, Black School of Business, Penn State Erie, The Behrend College, 4701 College Drive, Erie, PA, 16563, United States of America, szs15@psu.edu, John Shewchuk

We consider production-inventory systems serving two demand classes. One class provides advance demand information, and the other class does not. We assume early fulfillment is acceptable, and propose a policy for production replenishment and order fulfillment, which is shown to outperform the existing policies. Some managerial insights are also discussed.

5 - A New Class of Two Bin Policy for Inventory Rationing in a Continuous Review System
S Viswanathan, Professor, Nanyang Technological University, College of Business, Nanyang Avenue, Singapore, 639798, Singapore, asviswa@ntu.edu.sg, Sugoutam Ghosh, Rajesh Piplani

We propose a new class of two-bin policy for the continuous review, single item inventory system with two demand classes. The proposed two-bin policy assigns separate bins of inventory for the two classes. However, demand from the higher class can still be fulfilled with the inventory from the other bin, when its own bin is empty. The proposed policy can outperform the critical-level rationing policy when there is a minimum fill rate requirement for the lower demand class.

■ TD34

34- North 224 B- CC

Project Management: Teams, Dynamics and Incentives

Cluster: New Product Development

Invited Session

Chair: Karthik Ramachandran, Georgia Institute of Technology, Atlanta, GA, United States of America, karthik.ramachandran@scheller.gatech.edu

1 - Projects and Team Dynamics
George Georgiadis, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, United States of America, georgiadis@ucla.edu

This paper studies the dynamic collaboration of a team on a project that stochastically evolves to completion over time. The main result is that members of a larger team work harder both individually and on aggregate if and only if the project is sufficiently far from completion. By using this framework, I examine how a manager who recruits agents into a team to complete a project on her behalf should choose the team composition, as well as the agents' compensations.

2 - An Incentive Scheme to Resolve Parkinson's Law in Project Management
Bo Chen, Professor, University of Warwick, Warwick Business School, Gibbet Hill Road, Coventry, CV4 7AL, United Kingdom, Bo.Chen@wbs.ac.uk, Nicholas Hall, Xiaotie Deng

A major challenge in executing many projects is the widespread prevalence of Parkinson's Law, which results in wasting the benefit of potential early project completion. We design mechanisms that incentivize task owners to complete their tasks early when possible and to report their ability to do so when they realize this is possible with progress on their tasks. Our mechanisms further incentivize task owners to get ready for starting their tasks early.

3 - Consequences and Control of Procrastination in Projects
Yaozhong Wu, National University of Singapore Business School, 15 Kent Ridge Dr., Singapore, Singapore, yaozhong.wu@nus.edu.sg, Vish Krishnan, Karthik Ramachandran

We analyze how managers can design project tasks to influence procrastinating workers. We also report findings from an experiment on the effects of different task designs on individual worker's behavior and on the quality of their performance.

4 - Stakeholder Commitment: Product Development With Uncertainty
Jeremy Kovach, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Jeremy.Kovach@mgt.gatech.edu, Stylianos Kavadias

We explore incentive structures used by firms to motivate functional stakeholders' resource commitment decisions during NPD projects. We consider projects where as the project progresses, the locus of responsibility shifts from one functional stakeholder to another. We design optimal contracts for the functional stakeholders, factoring in the stakeholder's preference to resource commitment, in order to maximize project value based on the project uncertainty and project monitoring costs.

■ TD35

35- North 225 A- CC

Pricing and Revenue Management: Dynamic Pricing

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Hongmin Li, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, Hongmin.Li@asu.edu

1 - A Simple Heuristic for Joint Inventory and Pricing Problems with Lead Time
Yang Li, PhD Student, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, yang.li2@duke.edu, Kevin Shang, Fernando Bernstein

We study a joint inventory and pricing problem in a single-stage system with positive lead time. This problem is, in general, intractable due to its computational complexity. We develop a simple heuristic that resolves this issue. The heuristic first generates a pricing policy which depends on the initial inventory level. We then transform the joint problem into a standard inventory problem. This heuristic enables us to explore the impact of lead time on the joint decision.

2 - Price Optimization under Generalized Extreme Value Models
Amr Farahat, Assistant Professor, Washington University in St. Louis, Olin Business School, St. Louis, MO, United States of America, farahat@wustl.edu, Renyu (Philip) Zhang

We investigate the multi-product price optimization problem under the Generalized Extreme Value discrete choice model proposed by McFadden (1978). We present structural results leading to a tractable approach to solving this problem which exhibits the non-concavity issues inherent in its special case: the (nested) multinomial logit model.

3 - Cost-per-click Pricing for Display Advertising
Sami Najafi-Asadolahi, Rotman School of Management, University of Toronto, Toronto, Canada, Sami.Najafi@rotman.utoronto.ca, Kristin Fridgeirsdottir

We determine the optimal cost-per-click (CPC) price of display ads for a web publisher facing uncertain demand from advertisers requesting space on its website and uncertain supply of clicks from viewers. We formulate the problem as a queuing system. We show that the frequently used heuristic applied by most web publishers to convert between the CPC and CPM pricing schemes using the so-called click-through-rate can be misleading and may incur web publishers substantial revenue loss.

4 - Optimal Pricing for a Short Life-cycle Product When Customer Price-sensitivity Varies Over Time
Hongmin Li, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, Hongmin.Li@asu.edu, Tim Huh

Demand for technology products often resembles a diffusion process, with weak demand in the beginning and end of the life cycle and high demand intensity in between. The customer price-sensitivity also changes over the life cycle of the product. We study the pre-announced pricing decision for a product that exhibits such demand characteristics and determine the optimal set of discrete prices and the times to switch from one price to another, when a limited number of price changes are allowed.

■ TD36

36- North 225 B- CC

Advances in Discrete Consumer Choice Model

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Ruxian Wang, Research Scientist, Hewlett-Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, ruxian.wang@hp.com

1 - Alternative Model for Discrete Sales: A Comparison with Multi-choice Logit Model

Varun Gupta, PhD Student, The University of Texas at Dallas, 800 West Campbell Road SM30, Richardson, TX, 75080-3021, United States of America, varun.gupta@utdallas.edu, Metin Cakanyildirim

In this study we propose a discrete choice demand model that can be used to model sales for competitive goods. We use real life data to compare the performance of the proposed model with the well established multi-choice logit model. We chose real-life data on different products such as yogurt, beef, ketchup and candy melts.

2 - The Multi-product Newsvendor Problem with Consumer Choice

Joonkyum Lee, Doctoral Student, Cornell University, 301A Sage Hall, Ithaca, NY, 14853, United States of America, jl883@cornell.edu, Amr Farahat

We address the muti-product under a general consumer choice behavior, e.g., substitution and choice overload. We present a tractable relaxation of an exact LP formulation that yields a feasible solution coupled with an upper bound on the optimal value. The relaxation is based on a fluid approximation and dynamic display strategy. It can be solved by identifying efficient inventory levels. The method is shown to perform well compared to existing methods and provides tighter optimality gap bounds.

3 - Discrete Choice Models for Dynamic Decisions

So Yeon Chun, Assistant Professor, Georgetown University, McDonough School of Business, 37th and O Streets, Washington DC, 20057, United States of America, sc1286@georgetown.edu, Anton Kleywegt

Traditional discrete choice models assume that decision makers choose one alternative at a point in time, without the option to wait, collect more data, and revisit the decision later. We formulate a discrete choice model in which, at each decision time, decision makers have the option to postpone a decision until later. Alternatives and attributes may change over time, and decision makers attempt to forecast attribute values at the next decision time.

4 - Product Portfolio Selection and Bounded Price Optimization

Shiqian Ma, University of Minnesota, Church Street 207, Minneapolis, MN, 55455, United States of America, maxxx535@umn.edu, Ruxian Wang

We study product selection and price optimization with constraints on portfolio size and price bounds under the multinormial logit model. We propose a new efficient algorithm and investigate its performance in the static optimization as well as the dynamic problem.

5 - Multi-product Revenue Management and Price Optimization under Capacitated Discrete Choice Models

Ruxian Wang, Research Scientist, Hewlett-Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, ruxian.wang@hp.com

We consider a dynamic assortment and price optimization under the capacitated multinomial logit model with product-differentiated price sensitivities. The multi-product assortment and price optimization is transferred to a single-dimensional problem with a control of the aggregate resource consumption rate. By using the generalized efficient frontier with price optimization, we are able to establish a time-threshold structure for the dynamic problem.

■ TD37

37- North 226 A- CC

Location Objectives I

Sponsor: Location Analysis

Sponsored Session

Chair: Zvi Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu

1 - The Wisdom of Voters: Evaluating the Weber Objective at the Condorcet Solution

Mozart Menezes, Associate Professor of Operations Management, University of Calgary, Haskayne School of Business, Calgary, Canada, mozart.menezes@utoronto.ca, Zvi Drezner

We investigate the quality of Condorcet solutions comparing it to that of a central decision maker in the context of a locational problem, concluding, through exhaustive experiments, that if each population member votes according to his/her own self-interest, then the Weber objective at the Condorcet point is very close to the optimal Weber value. Being short of, or reducing the set of, candidate solutions has little impact on the quality of the Condorcet solution.

2 - Upper Bound on the Inefficiency of Condorcet Solution using Weber Optimal Value as Benchmark

Rongbing Huang, York University, 4700 Keele Street, Toronto, Canada, rhuang@yorku.ca, Mozart Menezes

This paper focuses on the worst-case quality of the Condorcet solution measured through the upper bound of the ratio of the Weber objective function value at the Condorcet solution to the Weber optimal objective function value. Prior work defined on networks showed the ratio to be 3. We show that on plane the ratio is smaller than 1.414. The result suggests that, when reducing the impact of topology, the solution originated via voting, it is much closer to optimality than previously suggested.

3 - Maximal Accessibility Network Design in the Public Sector

Robert Aboolian, California State San Marcos, 2771 Palmetto Drive, Carlsbad, CA, United States of America, raboolia@csusm.edu, Oded Berman, Vedat Verter

This paper is on the maximal accessibility facility network design problem for the public sector. The governments' mandate is to maximize the societal benefit by acting as agents of the public. Participants often patronize a publicly funded facility with highest accessibility. We assume that the time spent for receiving the service from a facility is a good proxy for its accessibility. We formalize the basic network design problem for the public sector and develop an exact approach to solve it.

4 - Stochastic Analysis of Ordered Median Problems

Zvi Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, Stefan Nickel, Hans-Peter Ziegler

Many location problems can be expressed as ordered median objective. In this paper we investigate the ordered median objective when the demand points are generated in a circle. We find the mean and variance of the k'th distance from the center of the circle and the correlation matrix between all pairs of ordered distances. By applying these values, we calculate the mean and variance of any ordered median objective and the correlation coefficient between two ordered median objectives.

■ TD38

38- North 226 B- CC

Service Operations Management: Forecasting, Capacity Planning, Scheduling and Performance Optimization

Sponsor: Service Science

Sponsored Session

Chair: Turgut Aykin, President and CEO, ac2 Solutions, Inc., 12 Crown Plaza, Suite 207, Hazlet, NJ, 07730, United States of America, taykin@ac2solutions.com

1 - Call Center Forecasting: State of the Art and Current Challenges

Turgut Aykin, President and CEO, ac2 Solutions, Inc., 12 Crown Plaza, Suite 207, Hazlet, NJ, 07730, United States of America, taykin@ac2olutions.com

Over the past two decades, call centers showed a tremendous growth and have become a major channel for customer service and sale. This presentation focuses on the state of the art in forecasting with i) multiple seasonality, and ii) short interval (e.g. 15-, 30-minute) forecasting. We will also review a number of simple methods used at call centers.

2 - Staffing and Capacity Planning at Service Systems

John McKenna, VP, Product Development, ac2 Solutions, Inc., 12 Crown Plaza, Suite 207, Hazlet, NJ, 07730, United States of America, johnsmckenna@ac2solutions.com

Resource planning at service systems is a collaborative effort involving operations, finance and line of business. In this session, we will discuss queuing models used for determining required staffing levels, and how they are used to support collaborative capacity planning.

3 - Concurrent Optimal Scheduling in Skills-based and Non-skills Based Systems

Liz Turner, ac2 Solutions, Inc., 12 Crown Plaza, Suite 207, Hazlet, NJ, 07730, United States of America, lturner@ac2solutions.com, Turgut Aykin

It is known that staffing costs account for 60-70% of the operating budget at a typical service center. Given this, considerable emphasis was put on optimal shift scheduling problems in the literature. This talk focuses on scheduling in skills and non-skills based systems and discusses Integer Programming based approaches for these problems.

4 - Performance Management and Optimization in Service Operations

John McKenna, VP, Product Development, ac2 Solutions, Inc., 12 Crown Plaza, Suite 207, Hazlet, NJ, 07730, United States of America, johnsmckenna@ac2solutions.com, Turgut Aykin

Forecasting, Capacity Planning and Scheduling are planning processes that are based on forecasts and other assumptions regarding the future. Deviations from assumptions during operations are unavoidable. This presentation describes several methods for managing performance in "real-time" including performance, skills and routing optimization, adherence and activity management.

■ TD39

39- North 226 C- CC

Topics in Operations Management II

Contributed Session

Chair: Wenjun Gu, Assistant Professor, Southern New Hampshire University, School of Business, 2500 North River Road, Webster Hall 217, Manchester, NH, 03106, United States of America, w.gu@snhu.edu

1 - Competing for Contracts on Price and Quality Variables

Edward Anderson, Professor Decision Sciences, University of Sydney Business School, Sydney, NSW2006, Australia, edward.anderson@sydney.edu.au, Cheng Qian

A buying firm chooses between several competing suppliers, who submit bids having both price and quality variables. We use a discrete choice model for the buyer to represent the uncertainty that exists from the supplier's perspective. We show that each supplier chooses its quality variables in a way that is independent of the competition; in a sense the suppliers "compete only on price". We also look at a model where the suppliers are uncertain about the buyer's weighting on quality variables.

2 - Joint Determination of Shipping Fees and Product Prices for Online Transactions

Nabita Penmetsa, University of Pittsburgh, Mervis Hall, Pittsburgh, PA, United States of America, NPenmetsa@katz.pitt.edu, Jennifer Shang

While the convenience and time saving offered by online transactions are attracting customers towards E-commerce, shipping fees is a major factor limiting some customers from buying products online. E-tailers offer discounts on shipping fees to attract customers, but the discounts impact profitability of firms as shipping costs are substantial. We develop a mixed integer programming model to find optimal product prices and shipping fees that maximize E-tailer profits.

3 - Product Quality Design in Reverse Supply Chain

Wenjun Gu, Assistant Professor, Southern New Hampshire University, School of Business, 2500 North River Road, Webster Hall 217, Manchester, NH, 03106, United States of America, w.gu@snhu.edu, Dilip Chhajed, Nicholas Petruzzi

This project studies how a manufacturer designs its product quality in a reverse supply chain when used products are collected, remanufactured and sold into the same market as the new ones. Results show that product quality generally increases in collection rate, but as does not hold in the presence of a retailer.

■ TD40

40- North 227 A- CC

Joint Session ENRE-Env & Sustainability/Energy: Environmental Energy Models

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability & Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Cheng-Marshal Wang, Environment Canada, 10 Wellington Street, 25th Floor, Gatineau, QC, K1A0H3, Canada, Cheng-Marshal.Wang@ec.gc.ca

1 - Carbon Mitigation and Competition

Zachary Gillerlain, University of Cincinnati, 2925 Campus Green Dr, Cincinnati, OH, 45221, United States of America, gillerzc@mail.uc.edu

We consider two firms in a single product environment. Using stylized models, we seek to determine the optimal number of stores for two competing firms in a carbon-regulated environment. We quantify the carbon impact of competition and we compare the actions of the firms to the actions that would be employed by a social planner under several carbon mitigating policies.

2 - A Stochastic Mixed-integer Programming Approach to Facility and Energy-technology Management

Stephen Stoyan, Analytics Manager, Starbucks Coffee Company, 2401 Utah Street S., Seattle, WA, 98134, United States of America, sstoyan@starbucks.com, Maged Dessouky

We present a model that addresses facility location and employs energy technologies that aim to improve a companies carbon footprint. The approach involves a Stochastic Mixed-Integer Program (SMIP) that minimizes cost, emission levels, etc. while also considering the optimal location in the companies network. The results provide encouraging outcomes with respect to cost, emission levels, and energy-technologies that should be utilized for future generation.

3 - A Combined Model of Classical and Impulse Controls for Emission and Stock Abatement Policies

Akira Maeda, The University of Tokyo, maeda@global.c.u-tokyo.ac.jp, Motoh Tsujimura

This study investigates emission and stock abatement policy decisions by the use of a stochastic optimal control model. We begin with our discussion by applying an absolute continuous control to emission flow abatement and management. Then, we extend the model to a direct control of carbon stock. We introduce a specific feature of the cost structure for stock control and assume the cost function is described as a discontinuous and subadditive one. For this extension, we use an impulse control.

4 - The New Energy Model Design on Oil Sand Production and Export

Cheng-Marshal Wang, Environment Canada, 10 Wellington Street, 25th Floor, Gatineau, QC, K1A0H3, Canada, Cheng-Marshal.Wang@ec.gc.ca, Nick Macaluso

International energy trading is of vital importance to Canada's continued economic growth. The uncertainty on Keystone XL and Gateway pipelines will affect the projection of Canadian oil sand export and production. We will develop a two-stage Stochastic Programming EC-IAM (Integrated Assessment Model) to explore the implications of energy productions and export. The Hoteling framework on modeling depletable resources will be reviewed and refined to better project Oil Sand production.

■ TD41

41- North 227 B- CC

Stochastic Programming Models for Wildfire Response Planning

Sponsor: Energy, Natural Res & the Environment/Forestry

Sponsored Session

Chair: Lewis Ntaimo, Associate Professor, Texas A&M University, 3131, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

Co-Chair: Julian Gallego, Texas A&M University, Enemerging Technologies Building, Industrial & Systems Engineering, College Station, TX, TX 77843-3, United States of America, kamizama77@tamu.edu

1 - A Simulation-optimization Approach for Large-scale Wildfire Extended Attack Response Planning

Michelle M. Alvarado, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, michelle.mcgaha@gmail.com, Lewis Ntaimo

Our simulation-optimization approach integrates a stochastic integer programming (SIP) model for wildfire extended attack planning with DEVS-FIRE, a fire spread and suppression discrete event simulation model. The SIP model optimizes the location and timing of the deployment of firefighting resources to an escaped large-scale wildfire. The SIP decisions and weather forecasts are used in DEVS-FIRE to generate fire spread scenarios, which become input for the SIP model in the next decision period.

2 - A Probabilistically Constrained Programming Model for Wildfire Initial Attack Planning

Julian Gallego, Texas A&M University, Enemerging Technologies Building, Industrial & Systems Engineering, College Station, TX, TX 77843-3, United States of America, kamizama77@tamu.edu, Lewis Ntaimo

We propose a stochastic integer programming standard response model for initial attack planning as an alternative to other methods in literature. Risk is incorporated in the model by imposing probabilistic constraints on the minimum standard production rate required at a fire. We report results based on one of the Texas Forest Service fire planning units in Texas.

3 - A Stochastic Integer Programming Model for Optimizing Suppression Resource Assignments on a Wildfire

Erin McCowen, Colorado State University, Forest and Rangeland Stewardship, 1472 Campus Delivery, Ft. Collins, CO, 80523-1472, United States of America, mccowene@gmail.com, Mike Bevers, Yu Wei

Assigning wildfire suppression resources safely and efficiently is a complex task. We developed a spatial stochastic programming formulation to model fire spread, intensity and suppression activities. Solutions to the model suggest optimal suppression activities for a known ignition given a probability distribution of random weather scenarios. The formulation is designed to handle multi-objective fire policies where portions of a fire may be allowed to spread and other portions are contained.

4 - Fire Season Suppression Resource Planning using Stochastic Programming

Yu Wei, Associate Professor, Colorado State University, Forest and Rangeland Stewardship, 1472 Campus Delivery, Ft. Collins, CO, 80523-1472, United States of America, wei@cnr.colostate.edu, Mike Bevers

We simulated growth of more than 1,000 historical wildfires for a fire planning unit using hourly fire weather data. Simulation results provided spatially realistic fire perimeter and area parameters for scenarios in an otherwise aspatial multistage stochastic integer programming fire containment model. Model solutions suggest optimal fire suppression resource stationing and dispatch decisions for a fire season. Results of an initial test case are reported for the Black Hills of South Dakota.

■ TD42

42- North 227 C- CC

Transportation Operations

Contributed Session

Chair: Seyed Behzad Aghdashi, PhD Candidate, North Carolina State University, 2510-203 Avent Ferry Rd, Raleigh, United States of America

1 - The Downhill Plow Problem with Multiple Plows

Benjamin Dussault, University of Maryland, Department of Mathematics, College Park, MD, United States of America, dussault@math.umd.edu, Bruce Golden, Edward Wasil

A common problem in winter is determining snow plow routes. We allow for multiple plows and observe that, on steep streets, it is difficult to plow uphill. This multiple plow problem seeks to minimize the maximum route length. We present a heuristic that generates solutions close to a lower bound.

2 - Capacity Optimization of Isolated Intersections Embedded with Sorting Areas

Chiwei Yan, Tsinghua University, Department of Industrial Engineering, Beijing, China, yan.cw08@gmail.com, Hai Jiang, Siyang Xie

In this research, we study a new urban traffic control strategy named "sorting area" in order to increase capacity of intersections with over-saturated arms. A Binary-Mixed-Integer-Linear-Programming (BMILP) model is established to get optimial signal settings and lane configurations on intersections embedded with sorting area. Numerical experiments are conducted to draw managerial insights. A simulation model is also developed to validate the model results.

3 - Inefficiency of the User Equilibrium in Congestion Games under Stochastic Demand

Chenlan Wang, Warwick Business School & DIMAP, Warwick Business School, The University of Warwick, Coventry, CV4 7AL, United Kingdom, phd10cw@mail.wbs.ac.uk, Bo Chen, Xuan Vinh Doan

We study the degradation in network performance caused by travellers' selfish behavior in a stochastic network environment. We present user equilibrium and system optimum conditions in non-atomic congestion games under stochastic demand on the basis of route choice model. Price of anarchy is adopted as the quantitative measure to study the inefficiency of the user equilibria under stochastic demand.

4 - Calibrating Traffic Flow Models through a Particle Filter Resemble Model using Time-series Detector

Yang Lu, University of Maryland, College Park, MD, 20740, United States of America, keenbat@gmail.com, Ali Haghani

The calibration of traffic flow models is a challenging task because analytical relationship between parameters and objective value is usually unobtainable. The computational complexity of GA method grows linearly with both the number of parameters and amount of field data used. This study proposed a particle filter resemble model to improve the computational efficiency of the parameter calibration process.

5 - Maximizing Traffic Flow Across a Freeway Facility using Ramp Metering

Behzad Aghdashi, Research Assistant, North Carolina State University, 2510-203 Avent Ferry Rd, Raleigh, NC, United States of America, saghdas@ncsu.edu

In this research a flexible mathematical model has been developed for modeling traffic across a freeway facility. This flexibility makes models capable of modeling and optimizing different demand management strategies such as ramp metering, managed lanes, and hard shoulder running. Stochastic nature of the freeway capacity has been incorporated in the proposed mathematical models. Finally a linear programming model is proposed for this purpose.

■ TD43

43- North 228 A- CC

State-of-the-art Implementation of OR Applications

Sponsor: Railway Applications

Sponsored Session

Chair: Marc Meketon, Vice President, Oliver Wyman, 1 University Sq., Suite 100, Princeton, NJ, 08540, United States of America, marc.meketon@oliverwyman.com

1 - Implement OR Model-driven Information Systems at Norfolk Southern

Clark Cheng, Director Operations Research, Norfolk Southern Corporation, 1200 Peachtree St NE, MS 12-117, Atlanta, GA, 30309, United States of America, clark.cheng@nscorp.com, Jignesh Patel

Operations research (OR) models are generally complicated by nature and therefore they are hard to understand and difficult to use for business users. In this presentation, we'll discuss how to combine operations research and information technology to develop strategic and tactical information systems. The goal is to provide practical and usable tools to assist management with better decision-making, enhance business competitive advantage, and improve operating efficiency.

2 - Unsung Heroes for MultiRail Development

Marc Meketon, Vice President, Oliver Wyman, 1 University Sq., Suite 100, Princeton, NJ, 08540, United States of America, marc.meketon@oliverwyman.com

Systems for optimization of railway operating plans rely on a combination of algorithms, well-thought user interfaces, advanced software concepts, and hardware architectural designs. In this talk we discuss the contributions of these unsung heroes on advanced architecture, database design, parallelization, and user interfaces on the development of MultiRail.

3 - Interactive Decision Support Systems for Better Railroad Planning

Ravindra Ahuja, President & CEO, Innovative Scheduling, GTEC, 2153 Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States of America, ravi@InnovativeScheduling.com

Service design teams at railroads create and maintain operating plans (blocking and train plans). But the actual execution may differ from the plan. In this presentation, we will give an overview and demonstration of a web-based, map-based interactive decision support system to analyze the actual execution from shipment, train, block, and terminal perspectives, compare with the plan, and perform root cause analysis of any variance.

4 - BNSF Visualization Studio

Rachel Salvagio, Manager Network Analysis, BNSF Railway, 2600 Lou Menk Drive, Ft. Worth, TX, United States of America, Rachel.Salvagio@bnsf.com, Ron Griffith

With velocity being a constant focus at BNSF Railway, we recently added a component within our Enhanced Service Design (ESD) tool called Visualization Studio that provides design managers information on velocity from a division level and waybill/car level. The product's powerful visual depiction allows users to quickly identify opportunities for improvement.

■ TD44

44- North 228 B- CC

Supply Chain, Practice and Empirics

Contributed Session

Chair: Jesus Jimenez, Assistant Professor, Texas State University-San Marcos, 601 University Dr, San Marcos, TX, 78666, United States of America, Jesus.Jimenez@txstate.edu

1 - The Growing Price

Jing-An Li, Academy of Mathematics and Systems Science, Chinese Academy of Sciences, No. 55, Zhongguancun East Road, Haidian, Beijing, 100190, China, ajli@amss.ac.cn

Recently, more and more cases are reported and questioned that the retail price of some vegetables is several times of the wholesale price. Produced by the manufacturer, wholesaled by the vendor, sold by the retailer, the vegetable's price is gradually growing. Using the knowledge of supply chain management, this paper will analyze this scenario, and will discover the secret of the growth.

2 - Supply Network Architectures: Antecedents and Consequences

Myung Kyo Kim, Doctoral Candidate, Michigan State University, North Business College Complex, 632 Bogue St. Rm N461, East Lansing, MI, 48824, United States of America, myungkyo@bus.msu.edu, Ram Narasimhan

A supply chain is an excellent example of a multi-level complex system which has a strict architecture in that it includes coordination and collaboration with multiple partners, thus supply chain managers behave as "network architects" by defining the objectives and designating member companies of the network. Responding to the needs for adopting network perspective to SCM, this study empirically investigates the antecedents and performance consequences of different supply network architectures.

3 - Has the Bullwhip Effect been Underestimated? - A Study Linking Customers and Suppliers

Olov Isaksson, Doctoral Candidate, EPFL, Station 5, ODY, 4.15, Lausanne, 1025, Switzerland, olov.isaksson@epfl.ch, Ralf Seifert, Pinar Uysal

We collect firm-level data that links customers with suppliers and estimate the size of the bullwhip effect. Contrary to previous studies, we find a significant bullwhip effect across industries. Our findings also show the bullwhip effect to be significantly higher than previously estimated. We investigate potential reasons for these differences.

4 - Variables Affecting the Semiconductor Manufacturing Supply Chain in the 450mm Wafer Size Transition

Jesus Jimenez, Assistant Professor, Texas State University-San Marcos, 601 University Dr, San Marcos, TX, 78666, United States of America, Jesus.Jimenez@txstate.edu, Garret Wilson

The semiconductor manufacturing industry is transitioning to 450mm wafers. There are several strategic-decision variables of the wafer size transition that will impact the entire semiconductor manufacturing supply chain; these variables include cycle time improvement, wafer transition cost, paying the bill, return on investment, productivity, and equipment/material. Empirical and simulation models were used in this research to evaluate the effects of these variables and provide recommendations.

■ TD45

45- North 229 A- CC

Joint Session JFIG/INFORM-ED; Maximizing Learning Impact with Web-Based Simulation and Classroom Activities

Sponsor: Junior Faculty Interest Group & INFORM-ED

Sponsored Session

Chair: Elizabeth Durango-Cohen, Illinois Institute of Technology, 565 W. Adams, Chicago, IL, United States of America, durango-cohen@iit.edu

1 - Using Simulation Software to Drive Conceptual Understanding in Undergraduate OM Course

Elizabeth Durango-Cohen, Illinois Institute of Technology, 565 W. Adams, Chicago, IL, United States of America, durango-cohen@iit.edu

In this talk, we'll discuss various simulation packages, including Littlefield Technologies, the EBeer game as well as the use of clickers, and their impact on student understanding and participation.

2 - Classroom Activities to Demonstrate Various Topics in OM/SCM

Ozgun Caliskan Demirag, Pennsylvania State University- Erie, The Behrend College, 5101 Jordan Road, Erie, PA, 16563, United States of America, ozc1@psu.edu, Berrin Aytac

This talk will present a number of classroom activities that can be used in teaching various OM/SCM topics. The activities are designed as relatively simple, short-duration, easy-to-prepare, and fun class exercises, which can be used to explain introductory concepts as well as clarify some of the more complex topics in the relevant areas.

3 - Online Games in Undergraduate Introductory OM Courses

Sam Wood, Responsive Learning Technologies, 4546 El Camino Real, #243, Los Altos, CA, 95014, United States of America, wood@responsive.net

Littlefield is a competitive online simulation used to teach introductory OM topics like process analysis and inventory control. Unlike the case for electives and graduate courses, big undergraduate sections of required OM courses appear to present special challenges when using online games like Littlefield. Using faculty interviews and data from actual Littlefield games over a four-year period we identify some specific challenges and test ways of addressing them.

■ TD46

46- North 229 B- CC

Game Theory: Application

Contributed Session

Chair: Monireh Mahmoudi, PhD Student, Wayne State University, 4815 Fourth Street, Department of Industrial & Systems Eng, Detroit, MI, 48202, United States of America, fc0581@wayne.edu

1 - A Game between a Government and a Tobacco Manufacturer
Md Ahmed, Research Assistant, University at Buffalo, SUNY, Buffalo, NY, 14226, United States of America, mtahmed@buffalo.edu, Changhyun Kwon, Jun Zhuang

Rice is the staple food of nearly half of the world's population. Ensuring domestic supply of rice from outside sources is difficult. In order to ensure food security, governments provide subsidy in agriculture. Sometimes, public money used for subsidy goes toward promoting undesirable crops like tobacco. We considers a game between a govt. and a tobacco manufacturer in which the govt. decides on a mix of subsidies and the manufacturer decides on declaring a purchase price of tobacco.

2 - A Mixed Leadership Game of Cooperative Advertising between a Manufacturer and a Retailer
Anshuman Chutani, Assistant Professor of Supply Chain Management (Visiting), School of Management, Binghamton University, P.O. Box 6000, Binghamton, NY, 13902, United States of America, achutani@binghamton.edu, Alain Bensoussan, Suresh Sethi, Shaokuan Chen

We study a class of sequential differential games where decision makers act both as leaders and followers depending on the nature of the decision. We develop feedback solutions in these mixed leadership differential games. We study an example of cooperative advertising between a manufacturer and a retailer, who decide national and local advertising rates, respectively. Each party first declares its share of other's advertising expenditure, and then both decide their respective advertising rates.

3 - A Game Theoretic Approach to Analyze Rear-ending Crashes
Indrajit Chatterjee, University of Minnesota, 500 Pillsbury Drive S.E, Minneapolis, MN, 55455-0116, United States of America, chat0123@umn.edu

Analyzing rear-ending crashes requires understanding driver behaviors in a typical braking-to-stop scenario. Such interactions between leading and following vehicle can be viewed as a product of evolutionary game, where a population of drivers is randomly paired in a two-player game. A stable long-run distribution of driving strategies is the outcome of the evolutionary process, which in-turn can be used to estimate the frequency of rear-ending crashes on congested freeways.

4 - Towards a Counterfeit-proof Global Supply Chain
Morteza Pourakbar, Rotterdam School of Management, Erasmus University, Burg Oudlaan 50, Rotterdam, Netherlands, mpourakbar@rsm.nl, Rob Zuidwijk

Counterfeiting activities are known as a major harm to legitimate supply chains. In this study, we investigate the role of customs authorities and rights-owners in the fight against counterfeiting. In a game setting, we analyze how customs and rights-owner alliance results in lower levels of counterfeiting risks.

5 - Competitive Pricing Dynamics under a Price Leader: Dairy Industry Case
Monireh Mahmoudi, PhD Student, Wayne State University, 4815 Fourth Street, Department of Industrial & Systems Eng, Detroit, MI, 48202, United States of America, fc0581@wayne.edu, Ratna Babu Chinnam

Data from five major dairy product firms were used to determine pricing status of ultrafiltration cheese. The leader firm claims to always sell the product near the ceiling price. We test the claims of the leader by calculating the optimal prices for all the firms in four different states using game theory principles. The price in each period was also predicted using a time series approach and compared to results from the game theory approach. The analysis supports the claim of the leader firm.

■ TD47

47- North 230- CC

Route Choice and Traffic Assignment

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Jing Ding, Research Assistant, University of Massachusetts Amherst, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, ding@engin.umass.edu

1 - Adaptive Transit Routing under Uncertainty
Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, Tarun Rambha, Travis Waller

An adaptive transit routing (ATR) problem on a stochastic transit network is defined and is formulated as a Markov Decision Process. State space reduction through pre-processing is achieved by solving variants of time dependent shortest paths and applying rules of dominance. Sampling based approximation techniques are used to solve an instance of the problem to demonstrate its application.

2 - Vacant Taxi Driver Routing Behavior Learning Process
Xianbiao Hu, Research Assistant, University of Arizona, 1209 E. 2nd Street, Tucson, AZ, 85721, United States of America, xbhu@email.arizona.edu, Yi-Chang Chiu

We propose a vacant taxi driver's routing behaviour model, within which a taxi driver determines his/her optimal route based on the experience traffic condition and customer arrival rate, but also learn from the actual realization. By the end of day taxi driver gains actual experience about the traffic situation and customer distribution, compares it to the previous experience, then forms updated knowledge for the next day. Numerical convergence analysis demonstrates the property of such a learning process.

3 - Hyperpath Equilibrium Models to Simulate Adaptive Routing Behavior
Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, Ravi Venkatraman, Avinash Unnikrishnan, Rachel James

An interactive online game is conducted to study adaptive routing behavior under the conditions of complete en-route information. In particular, this game aims to see how well drivers can use information, compared to the theoretical optimum value based on an online shortest path algorithm. Several behavioral contexts are studied.

4 - Adaptive Route Choice Models: Specification, Choice Set Generation, and Estimation
Jing Ding, Research Assistant, University of Massachusetts Amherst, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, ding@engin.umass.edu

We develop a modelling framework for adaptive route choice based on vehicle trajectory data in a general stochastic time-dependent network, here a traveler could revise route choice based upon real-time traffic information. We demonstrate the model specification, choice set generation algorithm, and estimation process in a large real-life network using synthetic data.

■ TD48

48- North 231 A- CC

Facility Logistics III

Sponsor: Transportation Science & Logistics/ Facility Logistics

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, ME 3258, Madison, WI, United States of America, ananth@engr.wisc.edu

1 - Solving the Reshuffling Problem in a Distribution Center
Jennifer Pazour, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, Jennifer.Pazour@ucf.edu, Hector Carlo

Over time, product demand profiles change; consequently, the assignment of products to locations in a distribution center also changes over time. We study the reshuffling problem, which occurs when products need to be rearranged in a distribution center. We develop a mathematical model and solution approach to determine the movement sequence that should be taken to transform an initial layout to a desired, final layout that minimizing travel time costs.

2 - Integrated Design of Order Picking and Sortation Systems
Fahrettin Eldemir, Assistant Professor, Yildiz Technical University, Industrial Engineering Dept, Yildiz, Besiktas, Istanbul, Turkey, feldemir@fatih.edu.tr, Recep Kizilaslan, Elif Karakaya

Order picking and order sorting are the two main operations that are mostly encountered within a warehouse. The research in the literature generally addresses the operational issues considering the both system as independent systems. In this study a performance evaluation model is suggested for the integration of the Order Picking Systems and Order Sortation Systems. Detailed aspects of design and operational parameters are addressed.

3 - Comprehensive Tactical Supply Chain Planning under Uncertainty
Aly Megahed, PhD Student, H. Milton Stewart School of Systems and Industrial Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, aly@gatech.edu, Marc Goetschalckx

We present a comprehensive two-stage stochastic supply chain tactical planning model for multi-period, multi-commodity, and multi-echelon supply chains. The first stage decisions include supplier selection and supplier contract design. The second stage decisions include inventory, backorder, transportation, product flow quantities and resource utilizations. The solution methodology and numerical results will be shared.

4 - Layout Design for Relief Centers in Disaster Affected Areas
Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, ME 3258, Madison, WI, United States of America, ananth@engr.wisc.edu

We use queuing models to analyze alternate layouts for relief centers that distribute relief aid to affected victims at a disaster affected region. The alternate layouts in the study integrate knowledge from the traffic control literature and we investigate the joint impact of the service needs of victims and accessibility constraints at the site.

■ TD49

49- North 231 B- CC

Pricing and Financing of Transportation Systems: I

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Yafeng Yin, Associate Professor, University of Florida, 365 Weil Hall, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu

1 - Managing Morning Commute with Tradable Mobility Credits
Marco Nie, Northwestern University, Evanston, IL, 60208, United States of America, y-nie@northwestern.edu

We assume that the congestion management authority will delineate a peak-time window and require all traveler who pass the bottleneck within that window to either pay certain units of mobility credits, or a peak time toll (which is comparably more expensive). The authority rewards credits to anyone who passes the bottleneck during the designated off-peak time window. An artificial market will be created so that the users may trade these credits with each other.

2 - Pricing Policy in a Stackelberg Game on Supply Chain Network with Imperfect Information
Tao Yao, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, taoyao@psu.edu, Amir Meimand, Terry Friesz

In this paper we present a model for stackelberg game on supply chain network in which supplier is a leader and retailers are followers and have uncertain observability of leader's policy which is the whole sale price. Then we study the effect of this uncertainty on the profitability of supplier and will discuss how different pricing policies can mitigate the negative effect of uncertainty.

3 - Optimal Dynamic Pricing for Parking Management
Sean Qian, Stanford University, Department of Civil & Environmental Eng., Stanford, CA, 94305, United States of America, seanqian@stanford.edu, Ram Rajagopal

The objective of this research is to maximize the benifits of parking management by optimal pricing and sensing. A generic parking model is presented for a set of sequential parking lots. We propose the system optimum and the minimum congestion parking pricing schemes. The model can be implemented in practice by utilizing parking sensors to set optimal on-line parking prices.

4 - Equity and Efficiency Analysis of Vehicle Usage Restriction, Ownership Quota, and Pricing Policies
Shanjiang Zhu, Assistant Research Scientist, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, zhuxx120@umd.edu, Longyuan Du, Lei Zhang

This research develops an analytical framework for analyzing and comparing transportation rationing policies, which consists of a mathematical model of joint household vehicle ownership and usage decisions and welfare analysis methods based on compensating variation and consumer surplus. This research extends previous research to consider multiple user groups on a network.

■ TD50

50- North 231 C- CC

Telecommunications

Contributed Session

Chair: Liang Zheng, Researcher, IBM Research - China, Diamond Building 19-A, Zhongguancun Software Park, Beijing, 100193, China, zhlzheng@cn.ibm.com

1 - Optimal Relay Node Placement in Sensor Networks using Node Cut Inequalities- A Branch & Cut Appraoch
Ashutosh Nigam, Doctoral Student, IIM Lucknow, FPM 28, IIM Lucknow, Lucknow, 226013, India, nigam.ashutosh@iiml.ac.in

Objective is to find a minimal set of relay nodes which facilitate communication between all source nodes (which sense the signals) and a root node. We provide a path based formulation and then discuss the concept of node cuts (set of relay nodes, deletion of which disconnects the source node and the root node) using which we propose an alternate projection formulation to solve the problem more efficiently. Facet defining conditions for the node cuts are also proved in the work.

2 - A Comparative Analysis of Steiner Ring Star Problem Formulations
Junsang Yuh, Korea University, Anamdong 5 Ga, Sungbuk Gu, Seoul, Korea, Republic of, yuhjunsang@korea.ac.kr, Youngho Lee, Gigyoung Park

We deal with the Steiner ring star problem arising from the design of telecommunication networks. We develop several mixed 0-1 integer programming models for subtour elimination constraints. By implementing the reformulation-linearization technique (RLT), we devise valid inequalities tightening the LP relaxation. Computational results compare the LP relaxation lower bounds and shows the effectiveness of the RLT procedures.

3 - Optimal Relay Selection Algorithm for Wireless Sensor Networks
Liang Zheng, Researcher, IBM Research-China, Diamond Building 19-A, Zhongguancun Software Park, Beijing, 100193, China, zhlzheng@cn.ibm.com, Hai Rong Lv, Jun Hua Ma, Wen Jun Yin, Jin Dong, Wei Zhao, Jin Feng

The paper issues an innovative algorithm to select relays in cooperative communication. The relay selection scheme can not only get quality QoS but also reduces the complexity of system, which is based on the eigenvalue decomposition. The simulation shows that compared wth direct communication, our method significantly improve the channel capacity and save the transmit power.

4 - Optimizing Fiber Delay Line Banks in Multi-channel Optical Switches
Yavuz Gunalay, Bahcesehir University, Faculty of Economics and Admin. Science, Besiktas, Istanbul 34353, Turkey, yavuz.gunalay@bahcesehir.edu.tr, Naik Akar

An optical packet switching system which has N input-output fibers and W wavelength channels for each fiber is considered. In such systems, fiber delay lines (FDL) can be deployed to resolve contention. The size of FDL bank is optimized for a given level of QoS.

■ TD51

51- North 232 A- CC

Joint Session: MAS/SPPSN/CPMS/SS: Tutorial: Transforming Military Supply Chains - Management Innovation in DoD

Sponsor: Military Applications, CPMS, The Practice Section, & Public Programs, Service and Needs

Sponsored Session

Chair: Greg Parlier, Colonel, USA Retired, Institute for Defense Analyses, 255 Avian Lane, Madison, AL, United States of America, greg.parlier@meitechinc.com

1 - Tutorial: Transforming Military Supply Chains - Management Innovation in DoD

Greg Parlier, Colonel, USA Retired, Institute for Defense Analyses, 255 Avian Lane, Madison, AL, United States of America, greg.parlier@meitechinc.com

This tutorial offers a practical approach for understanding the Army's extremely complex global logistics system. The new concept of "management innovation as a strategic technology" (MIST) is introduced and described. Cutting-edge supply chain theory and powerful analytical methods are applied to this seemingly intractable national security resource challenge which has remained on the Government Accountability Office's (GAO) "high-risk" list for two decades now.

■ TD52

52- North 232 B- CC

Joint Session ENRE Energy/Environment & Sustainability: Biomass Energy Market and Supply Chain

Sponsor: Energy, Natural Res & the Environment/Energy & Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50011, United States of America, lzwang@iastate.edu

1 - Renewable Energy and Competition for Biomass: Implications for Land use and Food Prices

Hayri Onal, University of Illinois at Urbana-Champaign, 305 Mumford Hall, Urbana, IL, 61801, United States of America, h-onal@illinois.edu, Xiaoguang Chen

Recent US energy policies aim to substitute fossil fuels with renewable fuels. The RFS relies largely on biofuels produced from biomass, RPS requires some of the power generation to come from biomass in addition to solar, wind, hydro, and geothermal sources. We present a large scale nonlinear MIP model to simulate the competition between RFS & RPS for limited biomass and determine the spatial layout of biomass production and location of processing facilities. Empirical results are presented.

2 - Competitive Supply Chain Design for the Emerging Biofuel Industry

Yun Bai, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, Urbana, IL, United States of America, yunbai1@illinois.edu, Jong-Shi Pang, Yanfeng Ouyang

We study a competitive supply chain design problem for an emerging industry which competes for resource supply with existing industries. A Stackelberg leader-follower game model is proposed to determine optimal facility location, scouring and pricing for the emerging industry, resource allocation for multiple suppliers. Lagrangian relaxation based solution approach is developed to solve the DC-MPEC model efficiently for large scale problem instances.

3 - Optimization of Agricultural Biomass Supply Chain for Cellulosic Ethanol Production

Taraneh Sowlati, University of British Columbia, Department of Wood Science, Faculty of Forestry, Vancouver, BC, V6T 1Z4, Canada, Taraneh.Sowlati@ubc.ca, Mahmood Ebadian, Shahab Sokhansanj

In this paper, a combined simulation/optimization model is developed to model and analyse Satellite Storages (SSs) in an agricultural biomass supply chain for cellulosic ethanol production. The time dependence and stochastic nature of the supply chain are taken into account using the simulation model. The optimization model addresses the optimum number and location of SSs. Three storage scenarios are identified and their efficiency are compared.

4 - Potential Competition of Biomass for Bioelectricity and Biofuel under Renewable Portfolio Standards

Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50011, United States of America, lzwang@iastate.edu, Mohammad Rahdar, Guiping Hu

We study the potential competition of biomass for bioelectricity and biofuel under the renewable fuel standard and renewable portfolio standards. Supply functions for biomass and other renewable energy sources are used to assess the availability of renewable energy resources; demand of renewable energy is estimated from EIA energy outlook, RFS2, RPS, and RPG.

■ TD53

53- North 232 C- CC

Pricing in Electricity Markets Including Nonconvexities

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Antonio Conejo, Professor, Universidad Castilla - La Mancha, Campus Universitario, Ciudad Real, 13071, Spain, Antonio.Conejo@uclm.es

1 - Do Centrally Committed Markets Provide Useful Price Signals?

Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu, Ashlin Tignor

The promise of restructured electricity markets is that prices, that are computed in a day-ahead unit commitment, provide signals for generation and transmission to enter and exit the market. We show that the prices generated by a centrally committed market are highly sensitive to which near-optimal solution is used, resulting in variable generator profits. We also show that peaking generators and transmission zones most prone to congestion are most likely to experience such variability.

2 - An Extreme-point Global Optimization Technique for Computing Convex Hull Prices

Gui Wang, University of Illinois at Urbana-Champaign, 206 Transportation Building, Urbana, IL, United States of America, xjtu.wg@gmail.com, Uday Shanbhag, Tongxin Zheng, Eugene Litvinov, Sean Meyn

We present an extreme-point-based algorithm for obtaining convex-hull electricity prices that relies on globally maximizing the Lagrangian dual of an MILP. Two practical limitations common to such methods are the requirement of complete subgradient information and zigzagging behavior close to the solution. The former was handled by avoiding explicit enumeration while the latter was mitigated by introducing an alternative merit function.

3 - Pricing of Nonconvexity – A Forward Capacity Market Experience

Tongxin Zheng, Technical Manager, ISO New England, 1 Sullivan Road, Holyoke, MA, 01106, United States of America, tzheng@iso-ne.com, Eugene Litvinov

Defining prices from a nonconvexity optimization problem is a very important issue in the electricity market with the lumpy resources. This paper presents a nonconvex forward capacity auction problem that minimizes the total consumer payment, as well as a zero uplift pricing scheme that is adopted in the forward capacity market in ISO New England under a zonal configuration.

4 - Finding Better Pricing Strategies for Electricity

Mingguo Hong, Midwest ISO, 5407 Alvamar Place, Carmel, IN, 46033, United States of America, mingguoh@hotmail.com

The Location Marginal Price (LMP) based electricity market design has an inherent weakness in that it cannot guarantee the recovery of a generator's startup and no load costs. As a result, the Regional Transmission Organization (RTO) would have to provide make-whole payment in settlement. RTOs in North America have made various design changes to improve pricing. This talk reviews the market design changes. It intends to reveal issues with LMP pricing and solicit alternative problem solutions.

■ TD54

54- Regency Ballroom A- Hyatt

Applications in Open Pit Mining

Sponsor: Energy, Natural Res & the Environment/Mining

Sponsored Session

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, anewman@mines.edu

1 - Long-term Planning for an Underground Mine

Michel Gamache, Professor, Polytechnique Montrèal, C.P. 6079 succ. Centre-Ville, Montreal, QC, H3C3A7, Canada, michel.gamache@polymtl.ca, Jean Collard

In this presentation, we will present a model of long-term planning for Raglan Mine, a large nickel mining complex in the Nunavik region at the extreme limit of Northern Quebec, Canada. We will discuss the mixed integer linear programming model and the constraints that are related to the various operating characteristics of this mine in the sub-Arctic Circle. Results of solutions will be presented.

2 - A Study of the Bienstock-Zuckerberg Algorithm: Incorporating Price Uncertainty

Marcos Goycoolea, School of Business, Universidad Adolfo Ibañez, Santiago, Chile, marcos.goycoolea@uai.cl, Daniel Espinoza, Eduardo Moreno, Gonzalo Muñoz, Maurice Queyranne

A major concern of mine planners is the volatility of ore prices. Ben-tal and Nemirovski propose a robust optimization model for dealing with this uncertainty that reduces to solving a second-order-cone programming problem (SOCP). We describe an extension of the Bienstock-Zuckergerg algorithm for the precedence constrained production scheduling problem (PCPSP) that incorporates uncertainty by using this robust optimization paradigm. Computational results on real data sets are presented.

3 - Evaluating Alternative Formulations for Open-pit Mine Block Sequencing

Thomas Vossen, University of Colorado at Boulder, 995 Regent Dr, Boulder, CO, United States of America, vossen@colorado.edu, Jose Ramirez

The objective of open pit mine block sequencing is to determine a feasible extraction schedule from an open pit mine that maximizes profits over a given planning period. We propose and evaluate alternative formulations for this well-known problem that are derived from a non-linear programming formulation, and discuss preprocessing strategies that can significantly reduce the size of the resulting problems. Experimental results show the potential of our approach.

■ TD55

55 – Regency Ballroom B - Hyatt

Transformation in Healthcare Delivery Through Industry-academic Cooperative Research and Implementation

Sponsor: Health Applications Society

Sponsored Session

Chair: Eva Lee, Professor and Director, Industrial and Systems Engineering Georgia Institute of Technology, Georgia Institute of Technology, Atlanta GA, United States of America, eva.lee@gatech.edu

1 - Reducing Surgical Site Infections

Eva Lee ,Professor and Director, Industrial and Systems Engineering Georgia Institute of Technology, Georgia Institute of Technology, Atlanta GA, United States of America, eva.lee@gatech.edu, Ling Ling

This project is joint with Grady Memorial Hospital. Surgical-site infections (SSI) are a national problem, occurring in an estimated 2.8% of all procedures (for some, it is up to 30%). It causes complication, prolong length and stay and unnecessary burden on patients, hospitals and 3-party payers. We describe our recent successes in reducing SSI for coronary artery bypass graft through systems modeling and process optimization.

2 - Appointment Access & Engineering Control of Healthcare Systems

James Benneyan, Northeastern University, 360 Huntington Ave., 334 Snell Engineering Center, Boston MA 02120, United States of America, benneyan@coe.neu.edu

In this work, we investigate value of engineering feeback control to dynamically adjust staff levels or work hours in order to achieve any acceptable appointment access limit.

3 - Supporting Multi-disciplinary Team (MDT) Collaboration Through the EMR

Harriet Nembhard, Pennsylvania State University, Philadelphia PA, United States of America, hbn2@engr.psu.edu

This talk aims to understand the role of non-clinical team members in a multi-disciplinary team and their utilization of electronic medical records. The work is interview-based and we will discuss some of our findings.

4 - Evaluating the Impact of Discharge Phone Calls

Larry Gamm, Texas A & M University, Heatlth Science Center, Bryan TX, United States of America, Gamm@srph.tamhsc.edu

We focus on evaluating the impact of Discharge Phone Calls have had on reducing readmission. We will discuss how the characteristics of these calls have in effecting the execution and their usefulness to patients and hospitals. We will also discuss the impact on actual hospital readmission rates through actual hospital data analysis.

■ TD56

56- Curtis A- Hyatt

Joint Session TMS/ORG: Outsourcing of Knowledge-Based Tasks: Challenges, Strategies, Performance, and Implications

Sponsor: Technology Management & Organization Science

Sponsored Session

Chair: Saikat Chaudhuri, Assistant Professor of Management, The Wharton School, University of Pennsylvania, 2029 Steinberg Hall-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA, 19104-6370, United States of America, saikatc@wharton.upenn.edu

1 - Capability Development Across Firm Boundaries: Comparing Offshore Outsourcing of R&D vs. IT Services

Saikat Chaudhuri, Assistant Professor of Management, The Wharton School, University of Pennsylvania, 2029 Steinberg Hall-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA, 19104-6370, United States of America, saikatc@wharton.upenn.edu

Motivated by globally disaggregating firms, we compare the performance drivers in the offshore outsourcing of more routinized, codified IT services with less routinized and codifiable R&D work, to identify the conditions under which more central tasks can be located outside. Our analysis of a sample of such projects by a leading vendor suggests that capability creation across firm boundaries is fruitful under certain organizational designs, bearing implications for notions of core vs. periphery.

2 - Coordination, Contracts or Control? The Drivers of Quality In Offshore Service Produciton

Ravi Aron, Assistant Professor, The Johns Hopkins Carey Business School, 100 International Drive, Room 1331, Baltimore, MD, 21202, United States of America, raviaron@jhu.edu, Praveen Pathak, Ying Liu

We study the factors that drive the quality of output in services produced offshore. We investigate how the nature of work, the extent of control exerted by buyers and suppliers of offshore services and the features of the contract all impact on the quality of work produced offshore. Our research is based on a panel data set (a balanced panel of suppliers and buyers) from multiple countries and multiple buyers and suppliers of offshore services.

3 - The Architecture of Multi-partner Alliances in R&D Projects: Scale, Ambidexterity and Integration

Anant Mishra, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, United States of America, amishra6@gmu.edu, Alan MacCormack, Aravind Chandrasekaran

Why are some partnering alliances more successful than others? And how should firms structure their partnering alliances, particularly when such alliances involve multiple partners? Using primary data on multi-partner alliances across 147 R&D projects in six different industries, we develop and test hypotheses that examines the interrelationship between the different elements of partnering architecture and quality performance in an R&D project.

■ TD57

57- Curtis B- Hyatt

Asymptotic Analysis of Large-Scale Service Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Guodong Pang, Assistant Professor, Pennsylvania State University, University Park, PA, United States of America, gup3@engr.psu.edu

1 - Control of Patient Flow in Emergency Departments: Multiclass Queues with Feedback and Deadlines

Junfei Huang, National University of Singapore, Singapore, 117592, Singapore, junfeih@gmail.com, Avishai Mandelbaum, Boaz Carmeli

We consider the control of patient flow through physicians in emergency departments: a choice must be made between triage patients who are yet to be checked vs. those who are in-process (IP). Physicians' capacity is modeled as a multi-class queueing system with feedback, in which triage patients face deadline constraints while IP patients incur delay costs. We propose and analyze a scheduling policy that minimizes total queueing cost while satisfying all constraints, asymptotically.

2 - On the Optimal Control of Matching Queues

Itai Gurvich, Northwestern University-Kellogg School of Management, Evanston, IL, United States of America, i-gurvich@kellogg.northwestern.edu, Amy Ward

We study a dynamic matching problem in which arriving jobs can leave the system only after being matched with one or multiple jobs of different types. In high-volume systems, a "matching pooling" condition, reminiscent of the "resource pooling condition" in parallel server queues, facilitates a reduction of the original problem to an equivalent shortage formulation. We prove that a greedy policy based on repeatedly solving static matching problems is asymptotically optimal.

3 - A Logarithmic Safety Staffing Rule for Contact Centers with Call Blending

Ohad Perry, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States of America, ohad.perry@northwestern.edu, Guodong Pang

We study a large-scale contact center that handles inbound and outbound calls. Inbound calls arrive as an exogenous stream of customers with impatience, while outbound calls are modeled as an infinite queue of jobs, waiting to be processed. The goal is to serve inbound calls subject to service level constraints while keeping the outbound throughput rate at a desired level. We show that a logarithmic safety staffing is sufficient to meet these objectives.

4 - Fluid Limits for Multiclass Many-server Queues with Reneging under Global FCFS Discipline

Weining Kang, University of Maryland at Baltimore County, Baltimore, MD, United States of America, wkang@umbc.edu, Guodong Pang

We consider a multiclass many-server queueing system, where customers from different classes are served according to a global first-come-first-serve discipline and will abandon from their queues when their patience times are reached. We establish the fluid limit for such a system under some mild assumptions on the general service and patience time distributions.

■ TD58

58- Phoenix East- Hyatt

Stochastic Models in Services and Computing

Sponsor: Applied Probability

Sponsored Session

Chair: Alan Scheller-Wolf, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu

1 - Exact Analysis of the M/M/2 with Setup Times and other Hard Variants

Anshul Gandhi, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, anshulg@cs.cmu.edu, Sherwin Doroudi, Alan Scheller-Wolf, Mor Harchol-Balter

Many classic queueing problems have a simple Markov chain representation, yet solving this Markov chain is very difficult. An example is the M/M/2/Setup system where there is a setup time to turn a server on. In this work, we introduce a novel technique to analyze Markov chains that works by combining ideas from renewal reward theory and busy period analysis. We demonstrate this technique by solving the M/M/2/Setup and other similarly difficult variants.

2 - The Benefit of Introducing Variability in Quality Based Service Domains

Ying Xu, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, yingx1@andrew.cmu.edu, Alan Scheller-Wolf, Katia Sycara

We consider a single-server queueing system in which the value customers obtain from service increases with service time but decreases with waiting time. We show that the system value can be improved by differentiating a homogeneous customer group into different service rates, even if the service rates are assigned independent of system state. Though such a differentiation service increases service time variance, the total waiting time can be reduced without affecting the total service time.

3 - Analysis of Border Crossing Stations

Katsunobu Sasanuma, PhD Student, Carnegie Mellon University, Heinz College, Pittsburgh, PA, 15213, United States of America, katz@cmu.edu, Robert Hampshire, Alan Scheller-Wolf

Border-crossing stations are often modeled using two connected birth-death Markov chains. However, the performance analysis of a model of border-crossing stations is complicated. We propose a new method to analyze such connected Markov chains. The method enables us to decompose Markov chains into basic sub-chains and makes our analysis simpler.

4 - Multi-priority M/M/c Queue

Jianfu Wang, PhD Candidate, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S3E6, Canada, jianfu.wang08@rotman.utoronto.ca, Opher Baron

The multi-priority M/M/c queue has been widely studied. However its exact analysis was restricted to cases with identical service rates for different customer priorities. We use novel queueing analysis to provide closed form solution when service rates differ.

■ TD59

59- Phoenix West- Hyatt

Quantitative Risk Management

Sponsor: Applied Probability

Sponsored Session

Chair: Jeffrey Collamore, Associate Professor, University of Copenhagen, Department of Mathematical Sciences, Universitetsparken 5, Copenhagen, DK-2100, Denmark, collamore@math.ku.dk

1 - Large Deviations for the Empirical Measure of an Importance Sampling Algorithm

Henrik Hult, Associate Professor, Royal Institute of Technology, Department of Mathematics, Stockholm, SE-100 44, Sweden, hult@kth.se, Pierre Nyquist

Extreme risk in a financial or actuarial context is often quantified by a quantile or other tail-based risk measure. However, there may be a need to compute many rare-event probabilities for an accurate evaluation of a risk measure. In this talk we present a large deviations result for the empirical measure resulting from an importance sampling algorithm and show how the associated rate function can be used to quantify the performance of the algorithm.

2 - Nested Rare Event Simulation in Risk Management

Jie Xu, Assistant Professor, George Mason University, 4400 University Dr, MS 4A6, GMU Engr Bldg RM2100, Fairfax, VA, 22030, United States of America, jxu13@gmu.edu, Anand Vidyashankar

Nested simulation is an important tool in assessing actuarial and financial risks. When the loss function involves extreme percentiles, use of Monte Carlo simulations within nested simulations will render the simulation solution inefficient. We address this problem by introducing a nested rare event simulation solution and describe the theoretical properties of our algorithm. We establish consistency and efficiency of our algorithm and provide a precise description of the simulation cost.

3 - Dynamic Network Models for Systematic Risk in Financial Systems and Related Asymptotics

Anand Vidyashankar, Associate Professor, George Mason University, Department of Statistics, 4400 University Drive, MS 4A7, Fairfax, VA, 22030, United States of America, avidyash@gmu.edu

Network models are being increasingly used to model and evaluate systematic risk in financial systems. However, it is known that systematic risk takes multiple forms and is dynamic in nature. To address this issue, we describe an evolving network model for financial systems and use network wide metrics(NWM) to evaluate the systematic risk. We provide a precise mathematical description of the asymptotic behavior of the NWM and their interpretations for the risk problem.

■ TD60

60- Remington- Hyatt

Airport Runway and Taxiway Scheduling

Sponsor: Aviation Applications

Sponsored Session

Chair: Karen Marais, Assistant Professor, Purdue University, 401 W. Stadium Avenue, ARMS 3225, West Lafayette, 47906, United States of America, kmarais@purdue.edu

1 - End Around Taxiway Operational Optimization Approaches

Payuna Uday, Graduate Student, Purdue University, 401 W. Stadium Avenue, ARMS 3173, West Lafayette, IN, 47906, United States of America, puday@purdue.edu, Karen Marais

The adoption of end-around taxiways at airports with parallel runways has the potential to increase runway throughput, and reduce fuel burn and surface emissions. This study presents decision support models based on the environmental consequences of these taxiways at one airport. Two types of decision rules are evaluated (a) static rules, based on always or never using the EAT or based on arrival time; and (b) dynamic rules that use random forests to assign taxiways on a per aircraft basis.

2 - Is Stochastic Runway Scheduling Computationally Implementable in Practice?

Senay Solak, Assistant Professor, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@isenberg.umass.edu, Gustaf Solveling, John-Paul Clarke, Ellis Johnson

We consider a stochastic version of the runway scheduling problem, and analyze it by developing alternative formulations and solution approaches. The results from the computational tests on realistic data sets indicate that practically implementable truncated versions of the proposed solution methods almost always produce high quality solutions.

3 - A Taxiway Planning Model Considering Runway Exit Selection for Landing Aircrafts

Wenda Liu, Tsinghua University, Main Building 616, Beijing, China, momo.63@163.com, Mo Yang, Peng Cheng

The efficiency of taxi process restricts the full use of airport runway capacity. We investigate the taxiway planning problem and discuss the significance of runway exit selection for landing aircrafts. A model based on mixed integer programming is proposed for the assignment of taxi routes and times. We test the model performance with taxiway operations of Beijing Capital International Airport. About 6.5 percent of taxi time can be saved, and calculation time is acceptable for application.

■ TD61

61- Russell- Hyatt

Decision and Risk Analysis for Emergency Management and Terrorism Risk

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: Gregory Parnell, United States Military Academy, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu

1 - Analyzing the Global Nuclear Detection Architecture

Gregory Parnell, United States Military Academy, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu, Jason Merrick

The Global Nuclear Detection Architecture (GNDA) uses a multi-layered, time phased, defense in depth strategy. The architecture uses materials protection, control, and accountability; security of radioactive sources, point of departure screening, at-sea interdiction, border protection, and maritime inspection. We provide the structure of an integrated modeling framework to use for system architecture trade-off analyses.

2 - Cyber Risk to Transportation Sector Industrial Control Systems

Barry Ezell, Chief Scientist, Virginia Modeling, Analysis and Simulation Center, 1030 University Blvd, Suffolk, VA, 23435, United States of America, bezell@odu.edu, Mike Robinson, Joe Weiss

The presentation describes an bridge tunnel and traffic operations center scenario to assess the impact of cyber intrusion in a surface transportation system. PRA simulation estimates the likelihood of each scenario. The cyber effects are injected into regional transportation simulation to assess the consequences of the scenarios. The desired outcome is to raise awareness of cyber issues associated with ICS and expose knowledge gaps and cyber vulnerability to critical infrastructure.

3 - Conceptualizations of Terrorism Risk

Seth Guikema, Assistant Professor, Johns Hopkins University, 313 Ames Hall, Department of Geog & Env. Engineering, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu, Terje Aven

There are many different conceptualizations of terrorism risk in use, and there is not yet agreement on a coherent framework for addressing terrorism risk. In this talk we give an overview of different ways of defining terrorism risk and the techniques used as measures of terrorism risk. We posit a framework that can help bring clarity to terrorism risk assessments.

4 - Strategic Planning for Nlets – A MODA "Soft-Skills" Approach

Terry Bresnick, Senior Principal Analyst, Innovative Decisions, Inc, Vienna, VA, United States of America, tbresnick@innovativedecisions.com, Steve Connell

For the last decade, Nlets, the International Justice and Public Safety Information Sharing Network, has used a facilitated MODA process to develop, update, and monitor its strategic plan. Nlets uses a Value-Focused Thinking approach to its strategic goals that includes operating in a high-quality, secure environment; growing the membership base; ensuring adequate staffing; ensuring adequate revenue; and reinvesting in its membership community.

■ TD62

62- Borein A- Hyatt

Agents and Machine Learning Techniques for Auctions

Cluster: Auctions

Invited Session

Chair: Wolf Ketter, Associate Professor of Information Systems, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, wketter@rsm.nl

1 - Structural Analysis and its Application to Multi-unit Sequential Dutch Auctions

Yixin Lu, PhD Candidate, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, ylu@rsm.nl, Eric van Heck, Alok Gupta, Wolf Ketter

We develop a structural model for multi-unit sequential Dutch auctions where multiple units of identical products are auctioned in sequential rounds. Using the real-world transaction data from a complex Business-to-Business (B2B) auction market, we demonstrate the effectiveness of our model in characterizing the dynamics of winning bids.

2 - Optimal Allocation for Display Advertising

De Liu, Associate Professor, Gatton College of Business and Economics, University of Kentucky, Lexington, KY, United States of America, de.liu@uky.edu, Huaxia Rui, Andrew Whinston

The spread of real-time display advertising creates a new challenge: how to efficiently allocate countless categories of impressions. We propose a new contingent contract based approach, in which a provider can offer each ad buyer variable quantities contingent on the realized number of impressions. The key advantages of this approach include accommodating heterogenious risk preferences, achieving better allocation efficiency, and joint allocation of multiple categories.

3 - A Kernel-based Combinatorial Auction

Sebastien Lahaie, Microsoft Research, 1290 Avenue of the Americas, New York, NY, United States of America, sebastien.lahaie@gmail.com

We present an iterative combinatorial auction that offers modularity in the choice of price structure, drawing on ideas from kernel methods. The auction is able to detect whether price complexity must be increased to clear the market, and converges to a sparse representation of nonlinear clearing prices. We also show that regularization enables the auction to compute approximate truth-inducing payments in a single run, in contrast to VCG payments which require as many runs as there are bidders.

4 - Approximating Equilibria in Sequential Auctions

Eric Sodomka, PhD Candidate, Brown University, 115 Waterman Street, 4th Floor, Providence, RI, United States of America, sodomka@cs.brown.edu, Amy Greenwald, Jiacui Li

We search for symmetric equilibria in sequential auctions by modeling the bidder's problem as a Markov decision process (MDP) and searching for stable transition probabilities, given bidder MDP policies. We quantify how approximately optimizing with respect to approximately stable transition probabilities corresponds to approximate equilibria. We converge to known equilibria for simpler problems and find new approximate equilibria for problems where analytical solutions are unknown.

■ TD63

63- Borein B- Hyatt

Behavioral Theory in Operations Management

Sponsor: Behavioral Operations

Sponsored Session

Chair: Andrew Davis, Assistant Professor of Operations Management, Cornell University, 401J Sage Hall, Ithaca, NY, 14853, United States of America, adavis@cornell.edu

1 - A Tale of Two Countries: Trust and Trustworthiness in China and the U.S.

Yanchong Karen Zheng, Massachusetts Institute of Technology, Sloan School of Management, 100 Main Street, Cambridge, MA, United States of America, yanchong@mit.edu, Ozalp Ozer, Yufei Ren

We experimentally investigate how cultural distinctions between China and the U.S. affect the efficacy of forecast sharing in a supply chain. We demonstrate that trust and trustworthiness are lower and decline more evidently with increasing risks in China. In addition, repeated interactions lead to reversed dynamics for the evolution of trust and trustworthiness in the two countries.

2 - A Laboratory Comparison of Auctions and Sequential Mechanisms

Anthony Kwasnica, Associate Professor of Business Economics, Pennsylvania State University, 332 Business Building, University Park, PA, 16802, United States of America, kwasnica@psu.edu, Andrew Davis, Elena Katok

When bidders incur a cost to learn their valuations, two common selling mechanisms are an English auction, and a sequential bidding process. We experimentally compare the two mechanisms, varying the entry cost, and find that, contrary to theory, average seller revenues are higher under the sequential mechanism, while average bidder profits are the same. We develop a model of noisy bidder entry costs that organizes the experimental data well.

3 - Learning and Forgetting: Vendor Quality Improvement

Anupam Agrawal, University of Illinois at Urbana-Champaign, 363 Wohlers Hall, Champaign, IL, 61820, United States of America, anupam@illinois.edu, Suresh Muthulingam

We assess the relative benefits of quality improvement initiatives (process improvement, quality assurance, and design improvements) and compare the learning and forgetting from these initiatives to those in autonomous learning. Our analysis of 4,700 initiatives indicates that (i)Induced learning decays at a slower rate than autonomous learning (ii)Quality Assurance initiatives provide more stable quality improvement results: the benefits persist over time.

4 - Reference Prices and Transaction Utility in Inventory Decisions

Jordan Tong, Assistant Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States of America, jtong@bus.wisc.edu, Jing-Sheng Song

We present a descriptive model of the effects of reference prices and transaction utility in a newsvendor setting. Our model predicts that an individual's order is irrationally increasing in past purchasing costs, decreasing in past selling prices, and decreasing in the proportion of high profit margin to low profit margin products in the portfolio. Three laboratory experiments support the model's predictions. Finally, we analytically investigate the implications of the model to a supply chain.

■ TD66

66- Ellis West- Hyatt

Joint Session DM/QSR: Various Applications in Text Mining

Sponsor: Data Mining & Quality, Statistics and Reliability

Sponsored Session

Chair: Seoung Bum Kim, Associate Professior, Korea University, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

1 - Detection of Changes in Blogger Sentiment using SVM-based Control Charts

Sungim Lee, Associate Professor, Dankook University, Korea, Republic of, silee@dankook.ac.kr

These days hundreds of millions of Internet users show personal emotions, feelings or thoughts through Blog posts on social media services. In this paper, we will show how to detect the changes in the blogger sentiment data using mulitvariate control charts.

2 - Text Mining Approach to Find the Key Sentences in Large Documents

Sugon Cho, Korea University, Seoul, Korea, Republic of, sugoncho@gmail.com, Seoung Bum Kim

Finding the key sentences and paragraphs is an important and challenging problem. In recent years, the amount of text data has grown astronomically and this growth has produced a great demand for text summarization. In the present study we applied the text mining methods to find the key sentences from large documents.

3 - Discovery of Associated Patterns in the U.S. Patent Database using Text Mining Approaches

Jeonghun Kim, Korea University, Seoul, Korea, Republic of, ppllkkoo@korea.ac.kr, Seoung Bum Kim

Patent is one of the largest sources of technological information. In this study, we elicit the associative patterns of patents by using various text mining algorithms. Real data were used to extract meaningful patterns from patent data.

4 - Hybrid Approach for Recommendation System with Content-based Features from Online Reviews

Minhoe Hur, Seoul National University, Seoul, Korea, Republic of, dninb.kr@gmail.com

Content features are widely used in recommendation system. Most previous works considered them as genre, cast or director. But they were superficial and had limitations to show the nature of contents. In this study, we proposed hybrid approach for recommendation. And the contents similarity was calculated with the extracted features from online reviews of the content after latent semantic analysis had been applied. We compared the performance measure to other methods in the conclusion.

■ TD67

67- Ellis East- Hyatt

Sensor-based Monitoring, Modeling and Analysis I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Cutter Tilt Modeling and Monitoring in Face Milling using High-definition Metrology

Hui Wang, University of Michigan, Ann Arbor, MI, United States of America, huiwz@umich.edu

This research uses surface data measured by high-definition metrology to monitor machine spindle setup and deflection that impact surface quality and part functions. Procedures were developed to estimate and monitor the hard-to-measure cutter tilts by integrating cutting force modeling and surface data patterns. A Ford case study has demonstrated the effectiveness of the proposed method. This research also establishes a theoretical framework of surface characterization driven by process physics.

2 - Optimal Sensor Placement for Partially Diagnosable Multi-station Assembly Processes

Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu, Kaveh Bastani

Sensor placement optimization aims to provide the desired level of diagnosability using minimal number of sensors in multi-station assembly processes. Previously proposed sensor optimization methods cannot handle the under-determined systems in which number of sensors is less than that of the process errors. We propose a sensor placement optimization method based on our newly developed diagnosability criteria which is the minimal mutual coherence to uniquely identify the process faults.

3 - Capability Enhanced Adaptive Sensor Allocation Strategy for Process Monitoring and Diagnosis in a Bayesian Network

Kaibo Liu, Research Assistant, H. Milton Stewart School of Industrial and Systems Engineering, 765 Ferst Drive, Room 109, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, kbliu@gatech.edu, Jianjun (Jan) Shi

Multivariate process control in Distributed Sensor Networks (DSN) is a challenging issue. This research study proposes a method to adaptively reallocate sensor resources based on online observations in a Bayesian network, which can enhance monitoring and diagnosis capabilities. Case studies are performed on a hot forming process and a cap alignment process to evaluate the performance of the proposed method under different objectives.

4 - Analytics of Faults
Irad Ben-Gal, Professor, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, bengal@eng.tau.ac.il

We consider a system which is inspected by a set of given sensors. The sensors' signature, which is prone to inspection error, enables to classify the system state and decide whether it is reliable, or needs certain preventive maintenance action. We study the performance of the analytics policy under different inspection and malfunctioning scenarios. We use both Rough Set Theory and Error Correcting Codes measures for this analysis.

■ TD68

68- Suite 312- Hyatt

Advances in Financial Engineering

Sponsor: Financial Services Section

Sponsored Session

Chair: Jim Primbs, Consulting Associate Professor, Stanford Unversity, 358 Huang Engr. Ctr., 475 Via Ortega, Stanford, CA, 943205, United States of America, japrimbs@stanford.edu

1 - Robust Portfolio Techniques for Coherent Risk Minimization
Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, jgoto@indsys.chuo-u.ac.jp, Akiko Takeda

Coherent risk measures have gained popularity in the finance literature. However, its optimization may suffer from fragility associated with estimation error. By employing a robust optimization modeling, we discuss a way for making the solution robust over a certain range of estimation uncertainty. We show that different types of uncertainty sets can be simultaneously employed without losing convexity. Also, we discuss the Goldfarb-Iyengar (2003)-like use of factor-model.

2 - Control Policy Optimization for Dynamic Asset Allocation
Yuichi Takano, Tokyo Institute of Technology, 2-12-1-W9-77 Ookayama, Meguro-ku, Tokyo, 152-8552, Japan, takano.y.ad@m.titech.ac.jp, Jun-ya Gotoh

We utilize a nonlinear control policy, which is a function of past asset returns or economic indicators, to construct a portfolio. Although our previous study has built a computational framework for selecting the best control policy from among nonlinear functions, it was difficult to handle a large-scale portfolio optimization problem. Thus in this presentation, we provide an efficient solution for optimization of a nonlinear control policy by using kernel principal component analysis.

3 - Market Price-based Convex Risk Measures: A Distribution-free Optimization Approach
Jonathan Li, University of Toronto, Toronto, ON, Canada, jli@mie.utoronto.ca, Roy Kwon

We extend a well-known risk measure that measures the impact of uncertainty resulting from mis-specification of derivative models by using an optimization-based approach that uses distributions based on non-parametric specification. This allows for incorporation of a much wider class of distributions that results in more revealing measures. Our risk measure can be formulated as a semi-definite optimization problem and can be efficiently solved.

4 - A Moment Approach to Pricing Exotic Options under Regime-switching
Michael Kim, Postdoctoral Researcher, University of California Berkeley, Berkeley, CA, 94720, United States of America, kimmi@mie.utoronto.ca, Jonathan Li, Roy Kwon

We consider deriving tight bounds for the price of a wide class of exotic options under regime switching. Our method enables a general class of polynomial-type stochastic differential equations to be considered for underlying price dynamics. The novelty of our method is to represent the moment structure of the underlying asset dynamics via semi-definite constraints, and to subsequently derive the bounds of the option price using semi-definite programming.

5 - Portfolio Optimization under Phase Locking
Roy Kwon, Associate Professor, University of Toronto, 5 King's College, Toronto, ON, M5S3G8, Canada, rkwon@mie.utoronto.ca

We consider a stochastic mean-variance optimization problem that uses a phase locking factor model for returns. A three regime switching process is generated to implement the phase locking. Computational results indicate that a strategy of active re-balancing via the stochastic MVO model is superior to a standard MVO approach even under transaction costs.

■ TD69

69- Suite 314- Hyatt

Applications of Risk Analysis

Contributed Session

Chair: Amir Hossein Ansaripoor, PhD Candidate, ESSEC Business School, 100 Victoria St.,NLB,#13-02, Singapore, 188064, Singapore, amirhossein.ansaripoor@essec.edu

1 - Highway-Rail Grade Crossing Safety on Shared Passenger and Freight Rail Corridors
Samantha Chadwick, University of Illinois at Urbana-Champaign, B-118 Newmark Civil Eng Lab MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, schadwi2@illinois.edu, Christopher Barkan, Rapik Saat, Nanyan Zhou

As interest in shared passenger and freight rail corridors grows, safety concerns related to this method of operation have come to light. The risks of interoperating freight trains and lighter, higher-speed passenger trains need to be understood. One aspect of this risk is highway-rail grade crossings. This presentation gives an overview of the challenges of grade crossings to intermixed high speed rail and heavy axle load operations, and presents an in-depth review of the research to date.

2 - A Bayesian Approach for Modeling Time to First System Failure in Satellite Architecture Decisions
Matthew Daniels, Graduate Student, Stanford University, 319 Middlefield Road, Palo Alto, CA, 94301, United States of America, mattpd@stanford.edu

The purpose of this paper is to understand the relative lifetime distribution for two satellite architecture alternatives, and to propose an inferential method based on Bayesian approaches for obtaining these distributions. This paper uses an extensive public database of satellite anomalies. With these data, I utilize Bayesian belief nets to obtain satellite lifetime distributions that integrate expert judgment with observations of subsystem anomalies in deployed satellites.

3 - Comparison of Energy Development Strategies using Monte Carlo Simulation and Decision Trees
Rafael Hartke, Oil and Energy Industry Consultant, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY, 14850, United States of America, dsprague@schwartzmsl.com

This presentation addresses traditional and non-traditional approaches to energy exploration, such as drilling for oil and natural gas, wood and wind. Risks abound in each, and examples addressing a number of these are presented. In oil and gas, the use Monte Carlo simulation and decision trees to evaluate multiple plays and partnership strategies is examined. In the wood pellet industry, Monte Carlo simulation is utilized to analyze hedging strategies with commodity prices.

4 - A Multi-stage Stochastic Programming Model for Managing a Sustainable Fleet Portfolio System
Amir Hossein Ansaripoor, PhD Candidate, ESSEC Business School, 100 Victoria St.,NLB,#13-02, Singapore, 188064, Singapore, amirhossein.ansaripoor@essec.edu, Fernando Oliviera

We study a fleet portfolio management problem faced by a firm deciding which vehicle to replace to its fleet. This article contributes to the literature on fleet replacement and sustainable operations by proposing a general decision support system for the fleet replacement problem using a multi-stage stochastic programming and conditional value at risk (CVaR) to account for uncertainty in the decision process. We apply the model to a real world case study.

■ TD70

70- Suite 316- Hyatt

Social and Economic Networks

Sponsor: Information Systems

Sponsored Session

Chair: Alireza Tahbaz-Salehi, Columbia Business School, 3022 Broadway, Uris Hall 418, New York, NY, 10027, United States of America, alirezat@columbia.edu

1 - A Network Centrality Approach to Public Goods
Ben Golub, Postodctoral Fellow, Massachusetts Institute of Technology, 30 Wadsworth St. E53-379, Cambridge, MA, 02142, United States of America, ben.golub@gmail.com, Matthew Elliott

We study coalition-proof equilibria of games where each player can repeatedly exert costly effort that provides different benefits to some others. The main result is a (never-vacuous) sufficient condition for such an equilibrium in terms of eigenvector centrality: the amount of effort an agent exerts is equal to a weighted sum of the efforts of the agents whose effort matters to him. We prove this without parametric assumptions using the Perron-Frobenius spectral theory of nonnegative matrices.

2 - Global Games over Networks
Pooya Molavi, University of Pennsylvania, L475 Levine Hall, 3330 Walnut Street, Philadelphia, PA, 19104, United States of America, pooya@seas.upenn.edu, Alireza Tahbaz-Salehi

We analyze a coordination game where players' payoffs depend on actions of their neighbors in a social network. As a result of strategic complementary among players' actions, the game has multiple equilibria when the payoffs are common knowledge; however, introducing some uncertainty results in a unique equilibrium. In this paper we provide a characterization of players' equilibrium strategy, and explore its dependence on the network structure.

3 - Decentralized Assignment and Hierarchical Crowdsourcing
Mohamed Mostagir, Massachusetts Institute of Technology, 77 Massachusetts Ave., D32-632, Cambrdige, MA, 02139, United States of America, mosta@mit.edu, Daron Acemoglu, Asuman Ozdaglar

Consider an assignment problem where a number of workers of unknown skill are to be matched to a number of tasks of unknown difficulty. Ideally, a taskmaster would prefer that the most skilled workers are assigned the most difficult jobs. However, workers prefer to take on easy tasks. We provide a mechanism and a payment scheme that induce workers to form a market for tasks and endogenously sort themselves according to their abilities so that the desired assignment is implemented.

4 - Iterative Auction Design for Graphical Valuations
Ozan Candogan, Massachusetts Institute of Technology, 32 Vassar St., Room D640, Cambridge, MA, 02139, United States of America, candogan@mit.edu, Daron Acemoglu, Asuman Ozdaglar, Pablo A. Parrilo

Multi-item iterative auctions are commonly employed in practice, for instance in the context of spectrum auctions and procurement auctions, often without efficiency guarantees. In this work, we focus on a special but realistic class of valuation functions, which we refer to as graphical valuations, and develop simple efficient iterative auctions. The auctions we provide are applicable in various practical environments and allow for items that exhibit value complementarity and substitutability.

■ TD71

71- Suite 318- Hyatt

Personalized Recommender Systems

Sponsor: eBusiness

Sponsored Session

Chair: Nachiketa Sahoo, Boston University, 595 Commonwealth Ave, Office 627, Boston, MA, 02215, United States of America, nachi@bu.edu

1 - Product Comparison Networks for Competitive Analysis of Online Word-of-mouth
Zhu Zhang, Assistant Professor, University of Arizona, 1130 E Helen St., Rm 430, Tucson, AZ, 85721, United States of America, zhuzhang@email.arizona.edu

By integrating network analysis with text sentiment mining techniques, we propose product comparison networks as a novel construct, computed from consumer product reviews. To test the validity of the therefrom derived product ranking measures, we conduct an empirical study based on a digital camera dataset from Amazon.com. The results demonstrate significant effect of network-based measures on product sales.

2 - Manipulation Resistant New Recommender Systems with Feedback
Shankar Prawesh, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, United States of America, shankar1@usf.edu, Balaji Padmanabhan

The focus of our presentation is the issue of manipulation in Top-N news recommender systems (NRS). These automated systems are target of manipulators who hire people to promote their articles or apps farther up in the roster. We address the issue of manipulation in NRS through a class of feedback functions and an adapted influence limiter algorithm – both are used in conjunction. We show that the proposed recommendation technique performs very well to thwart common manipulation strategies.

3 - Social Link Recommendation
Masoud Makrehch, Senior Research Scientist, Thomson Reuters, 333 Bay Street, Toronto, Canada, makrehchi@gmail.com

In this talk, several strategies for link recommendation and prediction are discussed. First, a taxonomy of the topic is presented. Then, social data and features are briefly discussed. Several link prediction methods including (semi)supervised and unsupervised techniques, and also link prediction using hidden topics are detailed. Finally, some applications and examples are outlined.

■ TD72

72- Suite 322- Hyatt

Approximation Methods for Stochastic Optimization

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Somayeh Moazeni, Research Associate, Princeton University, Sherrerd Hall, Charlton Street, Princeton, NJ, 08536, United States of America, somayeh@princeton.edu

1 - Improving Deterministic Bounds for Approximate Solutions to Stochastic Programs
Alex Gose, Graduate Research Assistant, North Carolina State University, Operations Research Program, 2152 Burlington Labs, Raleigh, NC, 27695, United States of America, ahgose@ncsu.edu, Brian Denton

Methods based on aggregation of rows and columns can be used to find deterministic upper and lower bounds for stochastic programs with continuously distributed random problem parameters. We discuss approaches for computing bounds in the context of a sequential algorithm with refinement on a partition of the support of the random problem parameters. Computational results comparing these methods are provided to evaluate the efficiency and quality of the bounds.

2 - Recursive Constrained Linear Regression with Application in Stochastic and Approximate Dynamic Programming
Reza Yaesoubi, Post-Doctoral Research Fellow, Harvard Medical School, 641 Huntington Ave., Boston, MA, 02115, United States of America, reza.yaesoubi@gmail.com

We consider the problem of constrained least squares when data are accumulating over time and the process that generates the data is not necessarily stationary. We discuss the applications of this problem in stochastic and approximate dynamic programming. We present an algorithm using a primal active-set and the Schure-compliment methods to solve constrained least squares problems in real-time. We also establish conditions under which the estimates provided by the algorithm are consistent.

3 - Smoothing and Parametric Rules for Stochastic Mean-CVaR Optimal Execution Strategy
Somayeh Moazeni, Research Associate, Princeton University, Sherrerd Hall, Charlton Street, Princeton, NJ, 08536, United States of America, somayeh@princeton.edu, Yuying Li, Thomas Coleman

Computing optimal stochastic portfolio execution strategies under an appropriate risk consideration presents many computational challenges. We propose an approach based on Monte Carlo simulations, a smoothing technique, and a parametric representation of a stochastic strategy to minimize mean and Conditional Value-at-Risk of the execution cost. We further handle constraints using a smoothed exact penalty function. The proposed approach can be generalized to other risk measures.

4 - Dynamic Learning in Resource Allocation for Survey Designs
Melania Calinescu, VU University Amsterdam, Faculty of Sciences, De Boelelaan 1081, Amsterdam, 1081HV, Netherlands, melania.calinescu@vu.nl, Barry Schouten, Sandjai Bhulai

We explore a resource allocation model in a system defined by an extremely large number of stochastic parameters. The exploration- exploitation trade- is represented by the decision to allocate scarce resources between learning about the system parameters to improve future decisions and choosing actions that contribute most to the total expected reward. This work is motivated by the challenges survey organizations are faced with in the attempt to increase the quality of survey estimates.

■ TD73

73- Suite 324- Hyatt

Dynamic Scheduling

Contributed Session

Chair: Guohua Wan, Professor, Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, 200052, China, ghwan@sjtu.edu.cn

1 - Automatic Scheduling System of LNG Storage Operations using Mathematical Programming

Tomohito Okamura, Asst.Manager, Osaka Gas Co.,Ltd, 4-1-2, Hiranomachi, Chuo-Ku, Osaka, 541-0046, Japan, t-okamura@osakagas.co.jp, Kenji Tsuzaki, Kouhei Harada, Atsushi Nitanda, Takahito Tanabe, Kaoru Kawamoto, Toshihiro Nitta, Naoki Shimada, Keisuke Kawata, Tomokazu Ueda

Operators choose which tanks LNG should be unloaded into, from which tanks LNG should be sent to vaporizers, or from which to which LNG should be transferred. These works are collectively called "LNG storage operations" We developed a system using mathematical programming which automatically derives daily schedules for LNG storage operations. Besides this system enables quick judgment and simulating future LNG storage operations for designing future LNG facilities.

2 - Dynamic Scheduling Policy in a Make-to-stock System with Two Demand Classes of Different Variability

Jieling Han, PhD Student, University of Washington, Michael G. Foster School of Business, Box 353200, Seattle, WA, 98195, United States of America, hanjl@uw.edu, Apurva Jain

In a two-class production-inventory system, we analyze the case where demand classes differ in their variability. We develop characteristics of the optimal policy to minimize the sum of holding and backorder costs across classes. We extend the analysis to the case where partial information about arrival process is available.

3 - Fresh Item Replenishment in the Absence of Inventory Data

Gustavo Ayres de Castro, SAP Americas, 4343 N Scottsdale Rd, Suite 260, Scottsdale, AZ, 85251, United States of America, gustavo.ayres.de.castro@sap.com, Sricharan Poundarikapuram, Bin Qin

Traditional solutions to fresh item replenishment require inventory data; this article presents an approach to this problem in the absence of such data. The main objective of our solution is to reduce the waste caused by perished items, which are generally returned to the manufacturer, while still supplying enough inventory to cover the demand. In our approach, we circumvent the lack inventory data by replacing it with an estimate calculated using information coming from the returned items.

4 - Distributed Feedback Control for Production, Inventory, and Greenhouse Gas Emissions

Seokgi Lee, PhD Candidate, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, seok.lee75@gmail.com, Vittal Prabhu

Continuous-time feedback control models for a production schedule, a production rate, and an inventory level regarding GHG emissions are proposed. The objectives of this model are to minimize customer demanded due-date deviations and guarantee safety stocks of inventories for demand uncertainty, respectively. Dynamics among those four functions are analytically examined, and production schedules with corresponding production rates and inventory levels considering GHG emissions are suggested.

5 - Revenue Management and Decision Behavior in a Two Machine Flow-shop

Guohua Wan, Professor, Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, 200052, China, ghwan@sjtu.edu.cn

We study an order acceptance and production scheduling problem in a two machine flow-shop within a limited period, where an order generates a profit if it is accepted and processed. The objective is to maximize the total revenue from the processed orders. We formulate the problem as a two-machine flow shop and develop a dynamic programming algorithm. We also design experiments to study decision behavior of the scheduler in such a shop.

Wednesday, 8:00am - 9:30am

■ WA01

01- West 101- CC

Topics in Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Agustin Bompadre, California Institute of Technology, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, abompadr@gmail.com

1 - The Branch-and-Sandwich Algorithm for Bi-Level Problems: Implementation and Computational Results

Polyxeni-M. Kleniati, Dr., Imperial College London, Department of Chemical Engineering, South Kensington Campus, London, SW7 2AZ, United Kingdom, polyxeni.kleniati03@imperial.ac.uk, Claire S Adjiman

The Branch-and-Sandwich algorithm (Kleniati and Adjiman, J. Global Optim., 2012) is a deterministic global optimization algorithm developed for optimistic bi-level programming problems with a nonconvex inner problem satisfying a regularity condition. Practical considerations, algorithmic options and performance are explored via a C++ implementation of the algorithm using the MINOTAUR open-source branch-and-bound toolkit (Leyffer, Mahajan, Munson, Linderoth and Luedtke).

2 - Strong Cuts for Polynomial Inequalities via Disjunctive Arguments

Mohit Tawarmalani, Purdue University, West Lafayette, IN, United State of America, mtawarma@purdue.edu, Jean-Philippe Richard

Recently, it was shown that the convex hull of bilinear covering set with non-negative variables can be obtained as a disjunction of orthogonal sets. In this talk, we consider relaxations for bilinear inequalities with bounded variables. We explore the tightness of these relaxations. Then, we extend the techniques to polynomial covering sets, separable quasi-concave knapsacks, and special cases of polynomial inequalities with positive and negative terms.

3 - A Direct Method for Deterministic Global Optimization of Nonlinear Optimal Control Problems

Benoit Chachuat, Imperial College, Centre for Process Systems Engineering, London, United Kingdom, b.chachuat@imperial.ac.uk, Boris Houska

We propose a tailored direct method for solving optimal control problems to global optimality. The method uses an adaptive control discretization approach to deal with the time-varying optimization variables. In order to find convergent bounds on the control discretization errors we develop an ellipsoidal set-propagation technique which is inspired from the fields of reachability analysis and robust control. We illustrate the advantages of this direct method with numerical examples.

■ WA02

02- West 102 A- CC

Discrete Decision Analysis Under Uncertainty

Sponsor: Decision Analysis

Sponsored Session

Chair: Tianyang Wang, Assistant Professor, Finance and Real Estate Department, Colorado State University, Fort Collins, CO, 80523, United States of America, tianyang.wang@business.colostate.edu

1 - A Copulas-based Sensitivity Analysis to Dependency

Tianyang Wang, Assistant Professor, Finance and Real Estate Department, Colorado State University, Fort Collins, CO, 80523, United States of America, tianyang.wang@business.colostate.edu, Eric Bickel

Dependency lies at the heart of many critical decisions, yet the current decision making practices lack the efficient tools of sensitivity analysis to dependencies among uncertainties due to assessing, modeling and computational challenges. In this paper, we present a general framework for identifying and analyzing the impact of the critical dependencies through the use of sensitivity analysis procedure based on copulas.

2 - Multi Attribute Utility Functions with Incomplete Preference Information

Luis Montiel, PhD, The University of Texas as Austin, 1 University Station, Austin, TX, 78703, United States of America, lvmontiel@gmail.com, Eric Bickel

We present a new method to explore multi-attribute utility functions when the decision maker's preferences are incompletely specified. We consider the multi-linear utility function and use a new simulation procedure called JDSIM to perform sensitivity analysis over the space of all possible utilities that match partially specified preferences. Finally, we present a case of study and illustrate the power of this procedure under relative elicitation.

3 - Reexamining Discrete Approximations to Continuous Distributions

Robert Hammond, The University of Texas at Austin, 1 University Station, Austin, TX, United States of America, robertkh@gmail.com, Eric Bickel

We analyze the performance of several discretization methods, extending the work of Keefer and Bodily (1983) by expanding their analysis of discrete approximations of continuous probability distributions using the Pearson distribution system, and adding some additional commonly used methods. We also propose some three-point approximations tailored to specific distribution types.

4 - Complexity for Hybrid Decision Problems

Yijing Li, University of Kansas, Lawrence, KS, 66046, United States of America, yjl@ku.edu, Prakash P. Shenoy

The main goal of this paper is to introduce the mixed tree method for solving the hybrid decision problem. We are able to solve the American Put Option Problem with many stages by approximating the conditional density functions using mixed trees, and the computation time grows linearly with the increase of the stages.We compare the optimal strategies obtained from LIP method with the mixed trees method.

■ WA03

03- West 102 B- CC

Panel Discussion: Enhancing Adolescentsí Lives through Decision-Making Skills

Sponsor: Decision Analysis

Sponsored Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

1 - Progress Report for The Decision Education Foundation

Moderator: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com, Chris Spetzler

The Decison Education Foundation has developed on-line curriculum to teach decision skills to youth. It has piloted this curriculum in a blended (classroom and online) course design. In thissession we will share the lessons learned and how Decision Professionals can participate in bringing decision skills to their local schools or extracurricular programs.

2 - Measuring Individual Decision-making Competence - The Basis for Well-grounded Training in Decision-making

Nadine Oeser, London School of Economics and Political Science, Houghton Street, London, United Kingdom, nadineoeser@gmx.de

Since good decision processes increase the probability of good decision outcomes, individual decision-making competence (IDMC) seems to be an important parameter to influence the achievement of such outcomes. Research on how to adequately measure and assess IDMC can help to create a better understanding of the different aspects of IDMC, capture an individual's status quo of decision-making performance, describe areas for improvement, and therefore, guide the teaching of decision-making skills. The present research aims to construct a psychometric test for IDMC, which measures mainly the quality of application of decision-making rules as taught by prescriptive decision science.

3 - Enhancing Adolescents' Lives through Decision-making Skills

Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

On the path to a successful career and happy personal life, adolescents face many complex decisions that significantly influence their lives. Improving their decision-making skills can have a positive impact with wider benefits across society. We discuss our learning and teaching experiences with children, adolescents and young adults and spotlight the questions of 'How can we professionally support adolescents improve their individual decision-making competence?'.

■ WA04

04- West 102 C- CC

Data Envelopment Analysis V

Cluster: Data Envelopment Analysis

Invited Session

Chair: Kostas Triantis, Program Director, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA, 22230, United States of America, triantis@vt.edu

1 - Axiomatic Semi-nonparametric Approach to the Estimation of Stochastic Distance Functions

Timo Kuosmanen, Professor, Aalto University School of Economics, PL 21220, Helsinki, Finland, timo.kuosmanen@aalto.fi, Andrew Johnson, Mika Kortelainen

Modeling joint production of multiple outputs under stochastic noise remains an important challenge in productive efficiency analysis. This paper extends the axiomatic semi-nonparametric StoNED approach to the general multi-input multi-output setting. Our theoretical model contains both the parametric distance functions and the nonparametric DEA as its special cases. Assuming radial inefficiency and noise, consistent estimators of the input and output distance functions are developed.

2 - Grease or Gamble? Corruption and Cross-country Productivity Differences

Antti Saastamoinen, Aalto University School of Economics, PL 21220, Helsinki, Finland, antti.saastamoinen@aalto.fi, Timo Kuosmanen

The effects of corruption on macroeconomic aggregates are vastly researched area. However, the applications of frontier methods, such as DEA or SFA, to the study of the effects on aggregate productivity are few. We employ a new semi-nonparametric frontier method to study the issue. Our results indicate that in addition to lowering the productivity level, corruption also contributes significantly in making the production environment more volatile, a result not identified by earlier research.

3 - The Incorporation of Multiple Scales in Efficiency Measurement: A Reconsideration

Kostas Triantis, Program Director, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA, 22230, United States of America, triantis@vt.edu

The purpose of this paper is to revisit some of the basic issues (measurement scales, coding, types of ordinal data, meaningful transformations) in the context of incorporating qualitative information expressed with ordinal scales in efficiency modeling paradigm. We provide insights by representing a simple counter example and we experiment using data from the DoD Corrosion Prevention and Control (CPC) project plans where a subset of these variables have been measured using ordinal scales.

4 - Algorithms for DEA with Streaming Data

Jose Dula, Virginia Commonweatlth University, 301 W Main St., Richmond, VA, United States of America, jdula@vcu.edu, Francisco Lopez

A challenge for DEA arises when data stream in quickly and the analysis needs to keep up. The relevant performance measure becomes the processing rate. This will determine the types of applications for this extension of DEA. Although computers and LP solvers play a major role in this, it is new algorithms that will permit real extensions of the performance limits. We explore algorithms especially developed for DEA with streaming data and report on their performance.

■ WA05

05- West 103 A- CC

Phase I Control Charting: New Directions and Research Opportunities

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Fadel Megahed, Assistant Professor, Auburn University, 3301L Shelby Center, Auburn, Al, United States of America, fmegahed@vt.edu

1 - A Distribution-Free Multivariate Phase I Location Control Chart

Allison Jones-Farmer, Auburn University, 415 W. Magnolia Ave., Suite 420, Auburn, AL, 36849, United States of America, joneall@auburn.edu, Richard Bell, Nedret Billor

A proper Phase I analysis is essential to the success of Phase II monitoring. This research develops a Phase I location control chart for multivariate processes. The resulting in-control reference sample can then be used to estimate the parameters for Phase II monitoring. The proposed method is compared to the Hotelling's T2 Phase I chart. The proposed method is shown to perform significantly better under non-normality.

2 - A Distribution-Free Phase I Control Chart Based on Empirical Likelihood Ratio

Arthur Yeh, Professor, Bowling Green State University, Wooster Street, Ann Arbor, OH, 43403, United States of America, byeh@bgsu.edu

In this work, we propose a new distribution-free Phase I control chart for monitoring location parameter whose construction is based on empirical likelihood ratio test. The performance of the proposed chart, in terms of the signal probability, is compared with that of the Mann-Whitney, Cramer-von-Mises and Kolmogorov-Smirnov based distribution-free Phase I charts for individual observations. A non-manufacturing example is included in which the competing charts are applied and compared.

3 - Maximum Entropy Distribution based Control Charts

Devashish Das, University of Wisconsin, Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, ddas3@wisc.edu, Shiyu Zhou

In this research we developed control charts based on the multivariate maximum entropy estimation of distribution. The maximum entropy distribution had an exponential polynomial form which could be multi-modal in nature. But the implicit function nature of the estimated distribution function helped in defining a new way to deciding control limits.We tested its performance on auto-correlated processes such as waiting time in queuing systems.

■ WA06

06- West 103 B- CC

Joint Session SIM/HAS: Healthcare Applications using Simulation

Sponsor: Simulation & Health Applications Society

Sponsored Session

Chair: Louis Luangkesorn, Research Assistant Professor, University of Pittsburgh, 3700 O'Hara St., 1048 Benedum Hall, Pittsburgh, PA, 15232, United States of America, lol11@pitt.edu

1 - Integrating Medical Decision Rules into a Simulation Model of Pre-hospital Medical Disaster Response

Filip Van Utterbeeck, Royal Military Academy, Renaissancelaan 30, Brussels, 1000, Belgium, filip.van.utterbeeck@rma.ac.be, Christophe Ullrich

We generate realistic victim profiles for medical disaster simulations based on medical expertise. We apply these profiles in a medical disaster model where victim entities evolve in parallel through a medical response model and a victim pathway model. The medical response model focuses on the pre-hospital phase which includes triage procedures, evacuation processes and medical processes. Medical decisions such as whether to evacuate or to treat the current victim are based on its RPM score.

2 - Modeling and Simulation of Sepsis: Explore the Therapeutic Agents in Intensive Care Unit

Zhenzhen Shi, PhD Student, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66506, United States of America, szztracy@ksu.edu, Chih-Hang Wu, Songnian Zhao, David Ben-Arieh

We present a system dynamics mathematical model and agent-based model, which model and simulate the basic components of innate immune response of Acute Inflammatory Response (AIR), the initial stage of sepsis. Results show different pathological situations of patients under various interventions of anti-inflammatory cytokines in AIR evolution. We also suggest a strategy for intervention of anti-inflammatory cytokines as potential therapeutic agents in the clinical settings.

3 - Resource Planning for the Redesign of Pre-Op and Post-Op Care Rooms using Discrete Event Simulation

Todd Huschka, Master Health Systems Analyst III, Mayo Clinic, 200 1st ST SW, Rochester, MN, 55905, United States of America, huschka.todd@mayo.edu, Thomas Roh, Thomas Rohleder, Jeanne Huddleston

To improve patient privacy and experience in the Mayo Clinic Post Anesthesia Care Unit (PACU) a we examined a new design, moving from a large "open-air" PACU room to individual rooms for each patient. The rooms will also serve as the Intake area into the Operating Room changing the intake process. A discrete event simulation model was built to forecast the potential impact on capacity and length of stay, and to determine optimal nurse and transporter scheduling.

4 - The Masking Effect of Averages for Healthcare Capacity Modeling

Louis Luangkesorn, Research Assistant Professor, University of Pittsburgh, 3700 O'Hara St., 1048 Benedum Hall, Pittsburgh, PA, 15232, United States of America, lol11@pitt.edu, Theologos Bountourelis, Spencer Nabors, Mina Kabiri, Andrew Schaefer, Gilles Clermont

Health care capacity decisions are often based on average performance metrics such as occupancy, however these may hide the effects of variability in the system. We demonstrate that occupancy and similar metrics do not reflect the ability of a healthcare system to provide patient service and propose using service based metrics for congestion as more suitable for healthcare settings. We then provide a case study where these metrics were used to advise a capacity expansion project.

■ WA07

07- West 104 A- CC

Joint Session DM/ICS: Integer Programming in Data Mining

Sponsor: Data Mining & Computing Society

Sponsored Session

Chair: Erhun Kundakcioglu, Assistant Professor, University of Houston, E209 Engineering Bldg. 2, Houston, TX, 77204, United States of America, erhun@uh.edu

1 - The Maximum Ratio Maximal Clique Problem

Samyukta Sethuraman, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, samyukta@tamu.edu, Sergiy Butenko

We introduce and study the maximum ratio maximal clique problem in graphs, which, given benefit and cost weights associated with each vertex, asks for a clique maximizing the benefit to cost ratio. This problem is motivated by network-based data mining applications.

2 - Multiple Instance Classification through Linear and Nonlinear Robust Support Vector Machines

Mohammad H. Poursaeidi, University of Houston, E 209 Engineering Building, Houston, TX, United States of America, mhpoursaeidi@uh.edu, Erhun Kundakcioglu

We investigate a multiple instance classification problem that is used for drug activity prediction and image annotation. Hard margin loss formulations that minimize the number of misclassified instances are proposed to model a more robust representation of outliers. Due to NP-hardness of the problem, we develop a three-phase heuristic algorithm for larger problems. Computational results show that the proposed method provides better cross validation accuracy compared to hinge loss formulation.

3 - Branch-and-price Algorithm for Maximum Weighted Clique Problem in Biomarker Identification

Seyed Javad Sajjadi, University of South Florida, 4202 Fowler Ave., Tampa, FL, United States of America, ssajjadi@mail.usf.edu, Bo Zeng, Xiaoning Qian, Amin Ahmadi Adl

To decrease the dimensionality of a data set in the feature selection algorithm, we identify a subset of most discriminating biomarkers by solving a multiple maximum weighed clique problem to optimality. We implement the branch and price technique to obtain the exact solution.

4 - Optimization Methods in Blind Signal Separation Based on Structural Assumptions

Mujahid Syed,University of Florida, Gainesville FL, United States of America, smujahid@ufl.edu, Pando, Georgiev, Panos Pardalos

Blind Signal Separation (BSS) is a common scenario that arises in practical data analysis. BSS can be stated as separation of original data from a mixture of data. Nonlinear mixtures are hard to separate; however, even for the case of linear mixtures, BSS has been termed as 'panacea'. Independent Component Analysis(ICA) is a BSS method based on statistical assumptions. In this talk, the usage of optimization methods in solving BSS problem with structural assumptions will be presented.

■ WA08

08- West 104 B- CC

Policy Models

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Paul Kerl, Georgia Institute of Technology, 500 Tech Parkway, Atlanta, GA, 30318, United States of America, paul.kerl@gatech.edu

1 - Distributed Alternating Direction Method of Multipliers

Ermin Wei, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D640, Cambridge, MA, 02139, United States of America, erminwei@mit.edu, Asuman Ozdaglar

We consider a network of agents that are cooperatively solving a global unconstrained optimization problem, where the objective function is the sum of privately known local objective functions of the agents. Recent literature for solving this problem focused on subgradient based methods. In this paper, we introduce a new distributed optimization algorithm based on Alternating Direction Method of Multipliers (ADMM) and show that this algorithm converges at the rate O(1/k).

2 - Designing a Pareto Improving Residential Electricity Rate Structure under Regulation

Seth Borin, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, sborin3@gatech.edu, Valerie Thomas

We investigate the effects on consumer behavior and utility profits of residential electricity rate structures under regulation, in a case study of the state of Georgia. We seek to design a long-run Pareto improving rate structure in which all parties are left no worse off than under the current rate structure. The resulting consumption levels, utility profits, greenhouse gas emissions, and impact on the net present value of energy efficiency investments are analyzed.

3 - Public Policy Decision-making Subject to Uncertain Implementation

Paul Kerl, Georgia Institute of Technology, 500 Tech Parkway, Atlanta, GA, 30318, United States of America, paul.kerl@gatech.edu, Joel Sokol

Public policy decisions are sometimes made as though an implementation is exact, with no unexpected deviations. We examine a stylized model of public policy decisions under uncertainty. We model altered decisions through a framework of uncertain optimization algorithms. We provide proofs of convergence and alternative step size and direction choices when using an uncertain method. Results are shown for a suite of problems, illustrating the importance of alternative decisions under uncertainty.

■ WA09

09- West 105 A- CC

Handling Many Criteria Decision-making and Optimization Problems

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Pekka Malo, Assistant Professor, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, pekka.malo@aalto.fi

1 - Interactive Evolutionary Algorithm for Solving Many Criteria Optimization Problems

Ankur Sinha, PhD, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, ankur.sinha@aalto.fi, Kalyanmoy Deb, Pekka Korhonen, Jyrki Wallenius

It is difficult to aim for the entire Pareto-optimal frontier in optimization problems with many criteria. Some of the recent studies target the most preferred solution by seamlessly integrating the decision maker with the execution of an evolutionary algorithm. In this study, we propose one such technique where preferences are elicited from the decision maker at the intermediate steps of an evolutionary algorithm to perform a focussed search in the region of interest.

2 - Document Classification: A Many-Criteria Optimization Problem

Pekka Malo, Assistant Professor, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, pekka.malo@aalto.fi, Ankur Sinha, Oskar Ahlgren, Pekka Korhonen, Jyrki Wallenius

Large dimensional problems are often encountered in information retrieval. The task of finding relevant documents can be viewed as a many-dimensional optimization problem, where each concept represents a dimension. In this study we propose a concept-based method for document classification. The procedure models the queries using a value function, which is learnt by solving a sequence of linear problems. The iterative nature of the process ensures that only relevant concepts are retained.

3 - Handling Constraints in Practical Optimization Problems

Santosh Tiwari, PhD, Vanderplaats Research & Development, Inc., 41700 Gardenbrook, Suite 115, Novi, MI, 48375, United States of America, stiwari@vrand.com

Most real-world optimization problems involve a large number of constraints. Quite often, many of these constraints are active at the optimum. In this talk, a discussion of constraint handling methods is presented. An overview of available tools and techniques, and associated methodology is also presented. Significant emphasis is placed on problems for which it is not possible to evaluate objectives if the constraints are violated. Also discussed is the issue of handling pass/fail constraints.

4 - Web-based Multi-Criteria Spatial Decision Support System DECERNS

Sergey Gritsyuk, PhD, National Research Nuclear University MEPHI, Studgorodok 1, Obninsk, Russian Federation, s.gritsyuk@gmail.com, Alexey Babutski, Boris Yatsalo, Vladimir Didenko, Oleg Mirzeabasov

DECERNS is a web-based spatial decision support system. It integrates GIS tools and MCDA methods. It can also be integrated with a model server containing site specific models. Integration between GIS and MCDA tools provided with setting spatial alternatives and map based criteria (automatically transfer attributes for alternatives to the performance table). The DECERNS WebSDSS has been implemented for investigation of several actual case studies on land-use planning, and risk management.

■ WA10

10- West 105 B- CC

Computational Methods for Risk-Averse Stochastic Programming

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Lewis Ntaimo, Associate Professor, Texas A&M University, 3131, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

Co-Chair: Michelle M. Alvarado, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, michelle.mcgaha@gmail.com

1 - Computational Study of Stochastic Programs with Mean-Risk Objectives

Tanisha Cotton, Doctoral Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, tanbgreen05@neo.tamu.edu, Lewis Ntaimo

We report on a computational study of stochastic linear programs with quantile deviation and absolute semideviation risk measures. To solve standard test instances from this class of problems, we implemented subgradient decomposition algorithms, which use either aggregated or separate optimality cuts to approximate the expectation and deviation terms of the mean-risk objective function. We discuss the performance of the algorithms in terms of several performance measures and draw some insights.

2 - Fenchel and Disjunctive Decomposition for Mean-Risk Stochastic Integer Programs

Michelle M. Alvarado, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, michelle.mcgaha@gmail.com, Lewis Ntaimo, Guglielmo Lulli

Mean-risk stochastic integer programs (SIPs) include both expectation and a dispersion statistic in the objective function and are hard to solve. In this talk, we introduce integrated Fenchel and disjunctive decomposition for mean-risk SIPs with fixed recourse. This new methodology is subgradient-based and generates Fenchel cuts based on a subset of scenarios and uses disjunctive programming to lift and translate the cuts so that they are valid for other scenarios.

3 - Branch-and-Cut Approach using IIS Cuts for Stochastic Integer Programs with Probabilistic Constraint

Julian Gallego, Texas A&M University, Enemerging Technologies Building, Industrial & Systems Engineering, College Station, TX, TX 77843-3, United States of America, kamizama77@tamu.edu, Lewis Ntaimo

Stochastic integer programs with probabilistic constraints (SIP-C) are difficult to solve because in general their feasible region is non-convex. We present a new branch-and-cut method for SIP-C with random technology and right-hand side based on irreducible infeasible subsystems (IIS). We report computational results based on standard instances.

4 - Disjunctive Cutting Plane Approach Two-Stage Mixed-Binary Stochastic Programs with CVaR

Nataly Youssef, Graduate Student, Massachusetts Institute of Technology, 143 Albany St., Apt. 014C, Cambridge, MA, 02139, United States of America, youssefn@mit.edu, Lewis Ntaimo

We present a disjunctive cutting plane approach to two-stage stochastic 0-1 programs with CVaR. We propose an outer branch and bound algorithm on the first-stage continuous variable introduced by the linearization of CVaR and perform an inner disjunctive cutting step on second-stage binary variables. We employ a simple convexification that does not involve reverse programming techniques. Computational experiments are conducted on standard instances to assess the performance of our algorithm.

■ WA11

11- West 105 C- CC

Algorithms for Nonlinear Optimization

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Frank Curtis, Lehigh University, 200 W Packer Ave, Bethlehem, PA, United States of America, frank.e.curtis@gmail.com

1 - A Sequential Quadratic Optimization Algorithm with Rapid Infeasibility Detection

Hao Wang, Lehigh University, Room 350, H.S. Mohler Laboratory, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, haw309@lehigh.edu, Frank Curtis, James Burke

We present a sequential quadratic optimization algorithm for nonlinear constrained optimization. The method attains strong global and fast local convergence properties for both feasible and infeasible instances, though we emphasize fast local convergence when solving infeasible problems. A two-phase strategy, carefully constructed parameter updates, and a line search are employed to promote such convergence. Numerical results are also presented.

2 - A Bundle Gradient Sampling Algorithm for Nonsmooth Optimization

Xiaocun Que, Lehigh University, 14 Duh Dr, Bethlehem, PA, 18015, United States of America, xiq209@lehigh.edu, Frank Curtis

We present an algorithm for solving nonsmooth optimization problems. The objective function may be nonsmooth and/or nonconvex. The method is based on bundle methods and the gradient sampling algorithm (GS). Preliminary results show that our algorithm yields benefits over GS. We will discuss the global convergence properties of the method.

3 - A Primal-Dual Active-Set Method for Convex Quadratic Optimization

Frank Curtis, Lehigh University, 200 W Packer Ave., Bethlehem, PA, United States of America, frank.e.curtis@gmail.com, Zheng Han, Daniel Robinson

We present a primal-dual active-set method for convex quadratic optimization. The method is based on that proposed for bound-constrained problems by Hintermueller, Ito, and Kunisch. However, we have extended the ideas to handle general linear constraints. In contrast to classical active-set methods, the method makes rapid changes in the active set. Computational experiments show that even for large problems (>1000 variables), the method is able to converge in only a few (<100) iterations.

■ WA12

12- West 106 A- CC

Joint Session Opt. INT/Minority: Integer Programming Techniques for Matroid Problems

Sponsor: Optimization/Integer Programming & Minority Issues

Sponsored Session

Chair: John Arellano, Rice University, 6100 Main St., Houston, TX, 77005-182, United States of America, jda2@rice.edu

1 - The Cunningham-Geelen Method in Practice: Branch-decompositions and Integer Programming

Susan Margulies, Research Associate, Pennsylvania State University, 318 McAllister Hall, University Park, PA, 16802, United States of America, margulies@math.psu.edu, Illya Hicks, Jing Ma

Cunningham and Geelen (2007) describe an algorithm for solving the integer program max{c^Tx : Ax = b, x >= 0}, which utilizes a branch-decomposition of the matrix A and techniques from dynamic programming. We report on the first implementation of the CG algorithm, and demonstrate that certain infeasible knapsacks instances with width <= 6 run in a matter of minutes with the CG algorithm, but in a matter of hours with the commercial integer programming software Gurobi.

2 - Integer Programming Techniques for General Branchwidth

Illya Hicks, Associate Professor, Rice University, Computational and Applied Mathematics, 6100 Main St., MS 134, Houston, TX, 77005-1892, United States of America, ivhicks@rice.edu, Elif Ulusal

We present an integer programming model to compute optimal branch decomposition of a submodular function over a finite set (general branch decomposition). General branchwidth, encompasses graphic branchwidth, matroidal branchwidth, and rankwidth. The presented model is based upon the relationship of the general branchwidth problem with laminar families and the maximum clique problem. We provide computational results to illustrate the computational efficacy of the approach.

3 - Integer Programming Techniques for Cocircuits of Linear Matroids

John Arellano, Rice University, 6100 Main St., Houston, TX, 77005-182, United States of America, jda2@rice.edu, Illya Hicks

I present a set covering problem (SCP) formulation of the matroid cogirth problem. Addressing the matroid cogirth problem for linear matroids can lead to significantly enhancing the design process of sensor networks by providing a means to evaluate the quality of the network. I briefly discuss existing methods developed to solve the matroid cogirth problem and the SCP. Computational results are provided to validate a branch-and-cut algorithm that addresses the SCP formulation.

■ WA13

13- West 106 B- CC

Integer Programming in Business Settings

Contributed Session

Chair: Zhihong Shen, Microsoft, One Microsoft Way, Redmond, United States of America, zhihosh@microsoft.com

1 - Real-time Price Optimization Model for Managing Multi-product Bids

Shivaram Subramanian, Senior Engineer, IBM Research, T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, shivaram.subramanian@gmail.com

We present a novel pricing optimization model used to provide real-time decision support to respond to a customers request-for-quote (RFQ) that typically consists of a core component and multiple accessories. We transform the resultant large constrained non-convex nonlinear optimization problem into a sequence of manageable Mixed-Integer Programs (MIPs) that can be solved relatively quickly. We present sample numerical results and discuss the business impact of this method.

2 - Optimal Design with Discrete Design Decisions and Competition in Prices

Mohamad Aslani, Graduate Student Research Assistant, Iowa State University, 2104 Black Engineering Building, Iowa State University, Ames, IA, 50011-2161, United States of America, mohamaec@gmail.com, William Morrow

Engineering design problems often involve discrete design variables. Moreover, these discrete design decisions often concern product 'topology' and must be made before other design decisions and prices are decided. This talk presents a multi-stage game-theoretic model for practical engineering design with discrete and continuous variables. We show how using the right formulation for continuous subproblems improves the performance of existing solvers on a problem of vehicle portfolio design.

3 - Movie Scheduling in Multiplex Cinemas

Wolfgang Brüggemann,University of Hamburg, Institute for Operations Research, Von-Melle-Park 5, Hamburg 20146, Germany, brueggemann@uni-hamburg.de, Henrick Heitmann

A movie schedule has to be generated in multiplex cinemas which specifies on which times, days and screens different movies are to be shown. Screens differ in their capacity, and the movies vary in their duration. Demand is given as the number of movie visitors at each possible start time. The aim is to calculate an optimal movie schedule which maximizes demand. A mixed-integer program is introduced. Results of a real application in cooperation with a multiplex carrier in Germany are presented.

4 - An Iterative Mining and Optimization Model to Improve User Engagement in a Loyalty Program

Zhihong Shen, Microsoft, One Microsoft Way, Redmond, United States of America, zhihosh@microsoft.com

In this work, we apply iterative data mining and integer programming models to increase customer engagement. We propose a two-stage model: in the first stage, we use data mining models to regroup users based on their similarities; in the second stage, we feed the results from stage one to an optimization model which aims to maximize the user engagement. We iterate these two stages and keep on improving the overall users' engagement rate. Some preliminary experimental results are included.

■ WA14

14- West 106 C- CC

Scheduling and its Integration with Other Operations

Cluster: Scheduling and Project Management

Invited Session

Chair: Zhixin Liu, Assistant Professor, University of Michigan - Dearborn, zhixin@umd.umich.edu

1 - Modeling and Solving an Integrated Workforce-Equipment-Production Planning Problem

Gang Li, Assistant Professor, Bentley University, 175 Forest Street, Waltham, MA, 02452, United States of America, gli@bentley.edu, Tian He, Hongxun Jiang, Youming Pang

We built an optimization model to assist a company to make integrated decisions on equipment purchasing, workforce recruiting and training, and production scheduling. A genetic algorithm based decomposition approach, combing with preprocessing and network optimization, was shown effective in solving this large scale problem.

2 - Supply Chain Scheduling under Multi-unit Competition Based on a Game Theory

Lixin Tang, Northeastern University, The Logistics Institute, Shenyang, 110004, China, lixintang@mail.neu.edu.cn, Feng Li

This talk studies scheduling model naturally arising in supply chain through multi-unit each of which has own scheduling requirement and objective. We model this problem as a non-cooperative game between these units where each unit is responsible for assigning all jobs belonging to a particular unit to the other unit. The local scheduling of these jobs is defined by a coordination mechanism. We proof that there always exists a Nash equilibrium and adopt the price of anarchy as a measure.

3 - Bicriteria Scheduling with Machine Unavailability

Hairong Zhao, Associate Professor, Purdue University Calumet, Hammond, IN, 46323, United States of America, hairong@purduecal.edu, Yumei Huo

In this paper, we consider bicriteria scheduling problems with limited machine availability constraints. We study both the parallel machine environment and the flow shop model. We give polynomial time algorithms and approximation algorithms for some problems; and for some harder problems, we develop heuristics and tested their performance by experiments.

4 - Order Acceptance for Two Classes of Demand with Heterogeneous Lead Time

Liang Lu, Universitè catholique de Louvain, CORE, Voie du Roman Pays 34, L1.03.01, Louvain-La-Neuve, NA, B-1348, Belgium, nicowish@gmail.com, Alejandro Lamas, Philippe Chevalier, Tanja Mlinar

We consider an infinite horizon order acceptance problem with two classes of demands for a make-to-order manufacturer. One class of demand generates a higher profit but poses a stringent lead time, while the other class generates a lower profit but only require a loose lead time. We formulate the problem as a multi-dimension Stochastic Dynamic Programming (SDP), and provide two heuristic approaches, namely, a threshold-based policy and a state reduction approach via partial state aggregation.

■ WA15

15- West 202- CC

Software Demonstration

Invited Session

1 - McGraw-Hill Higher Education – Practice Operations Multiplayer Simulation

Heather A. Kazakoff,Senior Marketing Manager, Operations & Decision Sciences, McGraw-Hill Higher Education, Two Penn Plaza 20th Fl., New York, NY, 10121, United States of America, heather_kazakoff@mcgraw-hill.com

Practice Operations is a multiplayer simulation of the clothing industry that enables students to practice operations and supply chain management in a competitive, real-world environment. Practice Operations is 3D and is designed for McGraw-Hill Education's line of digital learning products. Practice Operations supplements McGraw-Hill's Operations Management curriculum.

2 - Provalis Research – QDA Miner and WordStat

Normand Peladeau,President, Provalis Research, 2997 Cedar Ave, Montreal QC H3Y 1Y8, Canada, peladeau@provalisresearch.vom

Analyzing open-ended responses, customer feedbacks, social media, or interview transcripts is often perceived as a time-consuming process. Provalis Research will present two software tools, QDA Miner and WordStat, which allow one to quickly analyze large collections of text, extract information, identify patterns, discover hidden relationships and relate structured and unstructured data.

■ WA16

16- West 207- CC

Tutorial - Introduction to the Data Mining Process

Cluster: Tutorials

Invited Session

Chair: George Runger, Arizona State University, School of Computing, Informatics, and D, Tempe, AZ, United States of America, runger@asu.edu

1 - Introduction to the Data Mining Process

George Runger, Arizona State University, School of Computing, Informatics, and D, Tempe, AZ, United States of America, runger@asu.edu

This tutorial introduces data mining with a focus on the data mining process. Descriptions of the objectives, steps, terminology, differences from traditional statistical analysis, and common applications are presented. The breadth of scope is illustrated. The process of model, estimate, validate is outlined with some illustrative methods.

■ WA17

17- West 208 B- CC

Revenue Management of Differentiated Products under Competition

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Zizhuo Wang, Stanford University, Stanford, CA, United States of America, zzwang@stanford.edu

1 - Competition and Coordination in a Two-Channel Supply Chain

Elodie Adida, University of California at Riverside, School of Business Administration, Riverside, CA, United States of America, elodieg@ucr.edu, Amy David

We study competition and coordination in a supply chain in which a single supplier both operates a direct channel and sells its product through multiple retailers competing in quantities. We develop equilibrium strategies for the decentralized supply chain and, finding that such a supply chain is inefficient, we investigate the conditions under which revenue sharing, linear quantity discount, and linear price discount sharing contracts can act as coordination mechanisms.

2 - Data Driven Market Pricing and Portfolio Management
Jose Beltran, HP Labs, 1U-2, HP Labs, 1501 Page Mill Road, Palo Alto, CA, United States of America, jose-luis.beltran@hp.com, Kay-Yut Chen, Guillermo Gallego, Ruxian Wang, Jay Wang, Shelen Jain

Managing and pricing a portfolio of hardware products is a complex but essential task in competitive markets with small margins. Considerations include demand estimation, brand and feature valuation for multiple products in a rapidly changing environment, among other factors. We present a pragmatic approaches and optimization models of joint decisions of portfolio selection and product pricing.

3 - Capacity Investment Dynamics of Start-ups and Established Firms in a Vertically Differentiated Market
Gang Wang, Kenan-Flagler Business School, University of North Carolina at Chapel Hill, Campus Box 3490, McColl Building, Chapel Hill, NC, 27599, United States of America, Gang_Wang@unc.edu, Lauren Xiaoyuan Lu

We analyze the capacity investment dynamics of start-ups and established firms in a vertically differentiated market with uncertain demand. We find that a monopolistic start-up is more likely to invest early than an established firm, but tends to invest late for its high quality product than for its low quality product.In the duopoly setting, the capacity investment dynamics critically depends on quality differentiation.

4 - Static versus Contingent Pricing under Duopoly Competition
Zizhuo Wang, Stanford University, Stanford University, Stanford, CA, United States of America, zzwang@stanford.edu, Ming Hu

We compare static versus contingent pricing schemes in a competitive environment. We find that using a static pricing policy could alleviate the cut-throat price competition if demand turns out to be slack. This gain could outweigh the loss of not being able to exploit high demand turnout when it realizes. For a simple model, we derive necessary and sufficient conditions under which a static pricing policy achieves higher revenue. Numerical tests are performed to illustrate our results.

■ WA18

18- West 208 A- CC

Smart Services in Operation: Findings and Conclusions

Sponsor: Service Science

Sponsored Session

Chair: Helmut Aschbacher, Professor, University of Applied Sciences CAMPUS 02, Koerblergasse 126, Graz, 8021, Austria, helmut.aschbacher@campus02.at

1 - Smart Service – State of the Art (SOTA)
Andreas Aldrian, System Design Software & Application Engineering, AVL LIST GMBH, Graz, Austria, andreas.aldrian@avl.com, Christian Rackl, Jens Poggenburg

Service orientation and quality is getting increasingly important for the competiveness of enterprises. The development of smart services was identified as a key factor of success. Within this context this paper shows an approach in identifying coherence and common structures between different Smart Services and to develop a consistent system for creating new ones. The aim of this work is to establish a simple method for developing new Smart Services.

2 - Study Results: How IT Service Providers in Styria/Austria use Smart Services
Eugen Brenner, Professor, Graz Technical University, Inffeldgasse 16, Graz, 8010, Austria, brenner@tugraz.at, Ernst Kreuzer, Helmut Aschbacher

Based on a survey which was conducted 2010 and 2011 in Styria/Austria among 55 IT Service Providers the acceptance and the practical use of Smart Service approaches were researched. The survey results show good insight in the practical usage of preemptive service approaches (Smart Service concepts) of Styrian IT Service Providers. Furthermore strengths, weaknesses, opportunities and threats were examined due to the use of Smart Services in the B2B and B2C sector.

3 - Smart Services in the Austrian Biomass Boiler Industry: A Smart Services use Case Study
Josef Binder, CEO, Josef Binder Maschinenbau- und Handelsges.m.b.H., Mitterdorfer Strafle 5, Barnbach, 8572, Austria, binder.josef@binder-gmbh.at, Stefan Kroath

It can be observed that the biomass boiler industry uses service approaches which are very much reactive oriented. In this case study one of the leading industrial biomass boiler manufacturer with worldwide export shows ways how to use Smart Services to improve the customer contact (getting closer to customer) and to optimize internal service process. A technical concept is presented and strategic considerations are highlighted.

4 - Smart Services in the Waste and Resource Industry: A Best Practice Case Study
Willibald Erhart, IT Project Manager, Saubermacher AG, Hans-Roth-Strafle 1, Feldkirchen bei Graz, 8073, Austria, W.Erhart@saubermacher.at

The pioneer in Austria's waste industry early recognized the value of waste as a resource. In addition to the process steps that are necessary to close the entire lifecycle from waste to product, time and costs are the central key drivers for success. At this stage Smart Services offer a great possibility not only to optimize the production/service delivery but even to create superior customer experience by a proactive Smart Service approach. Conceptual/strategic considerations are highlighted.

■ WA19

19- West 211 A- CC

Readmisson and Patient Placement

Contributed Session

Chair: Adel Alaeddini, University of Texas at San Antonio, University of Texas at San Antonio, San Antonio, United States of America, adel.alaeddini@gmail.com

1 - A Decision Support Framework for Healthcare Transition Programs to Reduce Hospital Readmissions
Sabrina Casucci, PhD. Candidate & Research Assistant, University at Buffalo, SUNY, Department of Industrial & Systems Eng., Amherst, NY, 14260, United States of America, scasucci@buffalo.edu, Li Lin, Alexander Nikolaev

High hospital readmissions signal poor quality of post-hospital care and unnecessarily increase healthcare costs. Intervention programs aim to reduce readmission rates; yet there is little support for understanding the effect of physician and patient care decisions on the program outcomes. This paper focuses on the complexities of transitional care and the design of informative stochastic models that can provide decision support to all the stakeholders.

2 - Modeling Patient Flow and Readmission to the Intensive Care Unit (ICU)
Yazan Roumani, Joseph M. Katz Graduate School of Business, University of Pittsburgh, 241 Mervis Hall, Pittsburgh, PA, 15260, United States of America, yfr1@pitt.edu, Luis G. Vargas

Readmission is often associated with increased costs and increased risk of morbidity and mortality. On average, 7% of patients are readmitted to the Intensive Care Unit (ICU). We model patient flow while accounting for feedback (i.e. readmission) using discrete event simulation. We validate our model using real patient flow data that includes 4000 cardiac patients over a period of four years.

3 - Geographic Perspectives on Patient Cohort
Tze Chao Chiam, University of Massachusetts Memorial Healthcare, 11 Shattuck Street, Worcester, MA, 01605, United States of America, tze.chiam@umassmemorial.org, Lori Pelletier, Richard Forster

This study at UMass Memorial Medical Center investigates models to improve patient placement from ED and other sources to acute care units. Current process of assigning patient-to-bed and to-physician results in inefficiencies in patient care. Geographic cohorting of patients and physicians is the proposed solution to alleviate these problems. The use of simulation to study various levels of cohort and the assignment algorithms, results and lessons learnt from implementation will be discussed.

4 - Long Distance Triage: Assessing Risk for Inter-Hospital Transfer Patients
David Anderson, University of Maryland-Robert H. Smith School of Business, 3330F Van Munching Hall, College Park, MD, 20742, United States of America, danderson@rhsmith.umd.edu, Bruce Golden, Robert Habicht, Mangla Gulati, Edward Wasil, Kathryn Silva, Ryan Scilla, Majic Cina

In this paper, develop a method of identifying which inter-hospital transfer patients have high risk of mortality or being transferred to the ICU. Using only the patient's age, blood pressure, pulse, white blood cell count, and hemoglobin count, we are able to correctly identify 59% of high-risk patients and 89% of low-risk patients. This tool will be used to help admitting physicians place incoming patients in the right level of care.

5 - A Comprehensive Bayesian Framework for Prediction of Patient Readmission to Medial Centers

Adel Alaeddini, University of Texas at San Antonio, University of Texas at San Antonio, San Antonio, United States of America, adel.alaeddini@gmail.com, Kai Yang

Recent studies show a large number of patients discharged from hospitals experience unplanned readmission in the first 30 days of discharge. While the issue is very serious to medical centers and patients, most of high risk cases may be identified apriori. In this study we design a comprehensive framework based on survival models and Bayesian adaption for real-time estimation for readmission. Using a real dataset from a medical center we demonstrate the performance of the proposed methodology.

■ WA20

20- West 211 B- CC

Optimal Radiation Treatment I

Contributed Session

Chair: Likang Ma, University of Houston, 5800 Gulfton St., Apt. 1670, Houston, TX, 77081, United States of America, lma3@mail.uh.edu

1 - Impact of Intensity Modulated Proton Therapy Delivery Strategies for Mobile Lung Tumors

Laleh Kardar, PhD Candidate, University of Houston, 4707 Pin Oak Park Dr. Apt 912, Houston, TX, 77081, United States of America, lkardar@uh.edu, Wenhua Cao, Gino J. Lim

This study aims to investigate the effectiveness of several strategies in delivering optimized radiation dose distribution for mobile lung tumors. 4DCT datasets containing respiratory motion information at different phases of the respiratory cycle were used for lung cancer patients. Treatment plans with three irradiation fields were used for the analysis. Experiments showed that fractionated delivery and rescanning may reduce motion effects and improve dose homogeneity.

2 - Robust Evolution-Based Radiation Therapy

Arkajyoti Roy, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, roya@purdue.edu, Omid Nohadani

Radiation therapy plans are optimized for extended periods assuming invariant tumors. However temporal changes in anatomical geometry can significantly degrade the outcome. We develop an adaptive model that accounts for this change. To address deviations from the assumed change, we propose a robust method. This allows us redistribute the dose per fraction, improving the sparing of critical organs, particularly in worst-case scenarios. We demonstrate the advantages through a clinical case study.

3 - A New Approach to Direct Step & Shoot IMRT Optimization

Andrea Cassioli, Research Fellows, Department of Radiation Oncology-Massachusetts General Hospital, 30 Fruit Street, Boston, MA, 02114, United States of America, cassioliandre@gmail.com, Jan Unkelbach

We propose a new approach for Direct Step & Shoot IMRT Optimization based on column generation approach. In the master problem, we optimize the aperture weights and refine the MLC leaf positions at the same time. Gradients with respect to leaf positions are approximated based on the bixel grid, using a trust region like method. Numerical results show that the proposed approach increases the quality of the plan and the conformality of the delivered dose.

4 - GPU-based Bouned Variable Simplex Method for Solving Fluence Map Optimization Problem

Likang Ma, University of Houston, 5800 Gulfton St., Apt. 1670, Houston, TX, 77081, United States of America, lma3@mail.uh.edu, Gino J. Lim

Fluence map optimization (FMO) is one important problem in radiation therapy. Solving large scale FMO problem on CPU based algorithm is time consuming. We present a GPU-based bounded variable simplex method with steepest edge pricing algorithm to solve FMO problems in Intensity-Modulated Radiation Therapy (IMRT) and Intensity-Modulated Proton Therapy (IMPT). Numerical experiments show that our GPU-based solver outperforms leading commercial solver such as Cplex when using similar algorithm.

5 - Radiation Dose Optimization in Critical Organs

Yasaman Khodadadegan, PhD Student, Arizona State University, 699 S. Mill Ave., Brickyard Engineering (BYENG) 553, Tempe, AZ, 85281, United States of America, ykhodada@asu.edu, Muhong Zhang, William Pavlicek, Teresa Wu

The contribution of the Fluoroscopic Guided Interventional Radiology modalities to the organ dose is unknown. Although, these modalities emit low radiation doses, there exists a risk of cancer induction proportional to the absorbed dose in critical organs. We propose a mixed-integer programming model to decide on the geometry and energy which minimizes the absorbed dose with respect to the image quality. We provide results for the parallel implementation of the branch-and cut algorithm.

■ WA21

21- West 212 A- CC

Revenue Optimization and Related MDP Methodologies II

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Michael Katehakis, Department Chair and Professor, Rutgers University, Rutgers Business School, Newark, NJ, 07102, United States of America, mnk@rutgers.edu

1 - Unconstraining Airline Sales Data using Choice Sets

Ger Koole, Professor, VU University, De Boelelaan 1081a, Amsterdam, Netherlands, ger.koole@vu.nl, Alwin Haensel, Jeroen Erdman

Forecasting airline demand is a problem involving censored data because not all historic demand is observed and sometimes observed in different price classes because of the availability of tickets in different price classes. Forecasting the unconstrained sales is a problem that is crucial for airline revenue management. In this we present new methods based on maximum likelihoods and the expectation maximization algorithm. These methods are applied to real airline data.

2 - Analysis of (Q,r)-inventory Models with Exponential Lead Times by Successive Lumping

Flora Spieksma, Leiden University, Mathematical Institute, Niels Bohrweg 1, Leiden, 2333, Netherlands, spieksma@math.leidenuniv.nl, Dwi Ertiningsih

We assume that the demand is Poisson with rate lambda and the state of the system is the current inventory position. If the position is r-nQ, we place a new order of size Q, where the number of outstanding orders allowed is at most K. Sales get lost, if the inventory position is less then r-(K-1)Q. This can be modelled as a successively lumpable PH/M/K/K-queueing model. We will compare its performance with the (Q,r)-model with deterministic lead times.

3 - Applications of Successive Lumping in Optimization of Markov Chains

Laurens Smit, Universiteit Leiden, Leiden, Netherlands, laurens@pipe.nl, Michael Katehakis

We discuss a class of Markov chains called successively lumpable for which efficient computation (SLC) of quantities of interest (such as the steady state distributions) for large state spaces is feasible. We illustrate the applicability of the SLC method with several classical pricing and inventory models.

4 - Revenue Management under Randomly Evolving Economic Conditions

Jian Yang, Associate Professor, Rutgers University, 94 Rockafeller Road, Piscataway, NJ, 08854, United States of America, jian.yang@rutgers.edu, Yusen Xia

We consider a dynamic pricing model in which the rate of the demand arrival process is dependent on both the price charged by the firm and the state of the world. The worldly state evolves in a Markovian fashion. We establish the value of being better informed on the the worldly state. When reasonable monotonicity conditions are met, we show that better present economic conditions will lead to higher prices.

5 - Managed Print Service Pricing using a Linear Model for Customer Service Valuation

Jie Ning, University of Michigan, Ann Arbor, Industrial & Operations Engineering, Ann Arbor, United States of America, jien@umich.edu, Volodymyr Babich, John Handley, Jussi Keppo

We find optimal contracts for a managed print service provider with new institutional customers. Contracts considered comprise five parts: fixed price, variable prices for BW and color prints, and free-usage allowances for BW and color prints. Our pricing framework consists of two parts: a parsimonious valuation model that generates reliable estimates for the new customer's willingness to pay (WTP), and an optimization model that yields the optimal contracts.

■ WA22

22- West 212 B- CC

Learning

Contributed Session

Chair: Aviv Gruber, Researcher, Tel Aviv University, 7 Hanotea St., P.O.B. 171, Hadar-Am, 42935, Israel, avivgrub@post.tau.ac.il

1 - Ontology Learning from Text Corpora using Designed Lattice
Kiwook Jung, POSTECH, San31, POSTECH 4th Eng Bldg Room312, Pohang, Korea, Republic of, kiwook@postech.ac.kr, Hyunbo Cho, Boram Jo, Sanghyeon Koh

The promising use of ontology in solving problems that would require a high level of human expertise calls for efficient approaches to ontology development. However, current researches on such approaches have so far achieved limited success. The proposed approach is based on the interaction problem, which states that the knowledge to be encoded in ontology is greatly affected by what it seeks to solve. We use a designed lattice to formally describe the problem that can dictate ontology learning.

2 - Technology Selection Considering Multi-Technology Learning and Production Constraints
Richard Roth, Massachusetts Institute of Technology, 77 Mass Ave., room E38-428, Cambridge, MA, 02139, United States of America, rroth@mit.edu, Frank Field, Randolph Kirchain, Thomas Rand-Nash

Learning in existing technologies can change innovation timing and resource allocation decisions, particularly if manufacturing constraints prevent a complete technology switchover. This paper discusses optimal allocation decisions for production and R&D investments when multiple technologies learn and switchover constraints exist. Examples are presented from semiconductor and electric vehicle production.

3 - A Historical Review of Collective Intelligence
Zhongxian Wang, Professor, Montclair State University, 1 Normal Ave., Montclair, NJ, 07043, United States of America, prof.johnwang@gmail.com

This paper presents a brief overview of various aspects which comprise the field collective intelligence. Through this review of current research projects, the wide range of the field is demonstrated. Then briefly the some of the future directions of research within the field are examined.

4 - Target-based Bayesian Networks Application of Suspects Detection through Telecom Monitoring
Aviv Gruber, Researcher, Tel Aviv University, 7 Hanotea St., P.O.B. 171, Hadar-Am, 42935, Israel, avivgrub@post.tau.ac.il, Irad Ben-Gal

We present a Bayesian network application of suspects detection, through learning and characterizing behavioral patterns based on data from telecommunication objects. The learned network in this application represents the most informative and characteristic attributes for detecting a suspicious object and shows the connection among them. The algorithm was tested and verified along several datasets and in this application it demonstrates an adaptive capability to cope with special requirements.

■ WA24

24- West 213 A- CC

Healthcare Applications

Cluster: Health Informatics

Invited Session

Chair: Amin Khademi, PhD Student, University of Pittsburgh, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, AMK130@pitt.edu

1 - Approximate Dynamic Programming Approach to HIV Treatment Allocation in Resource Poor Settings
Amin Khademi, PhD Student, University of Pittsburgh, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, AMK130@pitt.edu, Denis Saure, Andrew Schaefer

HIV drugs are limited in the developing world. Motivated by this we use validated progression and transmission model of HIV to formulate the problem of allocating scarce treatment doses among a population of infected and susceptible individuals as a Markov Decision Process. In approximating the solution to our model, we used the linear programming approach. The policies derived from this work have been tested by a validated simulation which perform much better than World Health Organization ones.

2 - Real-time Decision Support System for Healthcare and Public Health
Sunderesh Heragu, Professor, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, s.heragu@louisville.edu, Gerald W. Evans, Phani Polina

In this talk, we will present a real-time decision support system (RTDSS) that can be used by emergency coordinators during a medical emergency, e.g., pandemic influenza attack. The RTDSS has two sets of tools - status and tracking tools as well as planning and analysis tools. Several modules embedded in the latter set of tools for resource allocation, vaccination planning, emergency department planning, and ambulance assignment are discussed.

3 - Metamodeling in Large Scale Healthcare Simulation
Theologos Bountourelis, Research Assistant Professor, University of Pittsburgh, 3900 O'Hara Street, Room 1048, Benedum Hall, Pittsburgh, PA, 15213, United States of America, thb28@pitt.edu, Louis Luangkesorn, Andrew Schaefer

Patient movement within a constrained health care delivery system is a dynamic and stochastic process that often defies analysis through standard analytical and predictive tools. Therefore, to adequately understand and optimize the management of ICUs, simulation modeling approaches may be taken. In this work we apply metamodeling tools to evaluate a simulation model over a range of values of parameters pertaining to available resources, clinical rules and patient Length of Stay.

4 - Implementing Sequential Best-subset Procedures on a Parallel Cluster
Mina Kabiri, University of Pittsburgh, 3900 O'Hara St., Room 1048 Benedum Hall, Pittsburgh, PA, 15213, United States of America, mik61@pitt.edu, Louis Luangkesorn, Theologos Bountourelis, Andrew Schaefer

Best Subset Selection (BSS) techniques derived from Ranking and Selection (R&S) methods are used to identify a set of good alternatives so policy makers can choose among them. However, indifference-zone-based sequential R&S procedures are not considered suitable when there are large numbers of alternatives. We explore applying the BSS method to a health-care system with thousands of alternatives on a parallel cluster and investigate issues that arise.

■ WA25

25- West 213 B- CC

Healthcare Applications I

Sponsor: Health Applications Society

Sponsored Session

Chair: Nebil Buyurgan, Associate Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, nebilb@uark.edu

1 - Impacts of Data Standards on Patient Risk in Healthcare
Paiman Farrokhvar, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, United States of America, pfarrokh@uark.edu, Nebil Buyurgan, Ron Rardin

Data standards can increase patient safety and decrease risk in terms of improved inventory accuracy, and recall and outdate management procedures. This simulation study investigates different inventory management models as well as recall and outdate management practices for fewer system errors and better accuracy. Different scenarios are compared to suggest the best practices.

2 - Pre-operative Activities and Operating Room Planning: A Local Hospital Department Case Study
Paolo Tubertini, PhD Student, University of Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, paolo.tubertini@unibo.it, Andrea Lodi

A local hospital department has to jointly plan operating room assignment to surgeons and patients admission planning taking in consideration, for a subset of patients, some compulsory pre-operative activities such as outpatient anesthetist appointment and blood pre-storage. We propose and test an MIP model with real data instances and we compare the results with actual planning procedures.

3 - The LRIM Tool for Evaluating the GS1 Data Standards Implementations at Healthcare Providers

Vijith Varghese, Postdoctoral Fellow, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, United States of America, vvarghe@uark.edu, Ron Rardin, Danny Dixon, Nebil Buyurgan, Mehmet Serdar Kilinc, Paiman Farrokhvar, Kaan Okyay

Supply chain automation complemented with data standards adoption, streamline operations and improve efficiency in healthcare supply chain. However, the struggle to justify returns on those investments hinders the widespread adoption. In this presentation, we describe the Levels, Requirements and Impact Model (LRIM), a spreadsheet decision tool that helps prospective provider adopters meet the critical need for information about the potential returns on investments in GS1 data standards.

4 - Understanding IT Adoption in Homehealth Domain by System Dynamics

Mehmet Serdar Kilinc, University of Arkansas, 4207 BELL Engineering Center, Fayetteville, AR, United States of America, serdarmehmet@gmail.com, Nebil Buyurgan

Homecare organizations have been struggling with many problems such as financial issues, changes in reimbursement methods, and lack of human resource. Integration and utilization of IT can improve efficiency and reduce costs in both clinical and supportive operations. This study attempts to analyze IT diffusion over mobile devices and telehomehealth. A system dynamics model is utilized to investigate the barriers and outcomes of each technology adoption and explore the interaction between them.

■ WA26

26- North 221 A- CC

Managing Disruption Risks in Decentralized Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

1 - Optimal Contracts for Outsourcing of Repair and Restoration Services

Sameer Hasija, INSEAD, Fontainbleau, France, sameer.hasija@insead.edu, Nitish Jain, Dana Popescu

We develop a novel principal–agent model by integrating elements of the machine repairman model and a stochastic financial distress model within the double-sided moral hazard framework to study a firm's problem of contract design for outsourcing repair services. Our analysis provides normative guidelines to managers on the structure of optimal repair contracts. We also provide theoretical support for the extensive use of tiered contracts in practice.

2 - Efficiency of Simple Penalty Contracts When Suppliers Can Improve Reliability

Woonam Hwang, PhD Student, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, whwang.phd2009@london.edu, Nitin Bakshi, Victor DeMiguel

Firms facing supply uncertainty often use simple penalty contracts to induce greater supplier effort for improving reliability. We investigate the efficiency of a unit penalty contract under three broad categories of supply risk: random capacity (RC), random disruption (RD) and random yield (RY). We find that a unit penalty contract always coordinates the supply chain under RC and RD, but it does not under RY, and the performance depends on the timing of the reliability investment.

3 - Disruption Risk and Supply Chain Structure

Robert Swinney, Associate Professor, Graduate School of Business, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, swinney@stanford.edu, Erjie Ang, Dan Iancu

We consider the impact of supply chain structure on a manufacturer's disruption risk management strategy. Motivated by the impact of the 2011 Tohoku earthquake and tsunami on Toyota's supply chain, we explore how different relationships between upper tier and lower tier suppliers can affect the downstream manufacturer's preference for alternative risk mitigation tactics.

4 - Competitive Disruption Mitigation in a Supply Chain

Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

Firms managing equipment prone to breakdowns institute plans to perform preventive and reactive actions to avoid or reduce costly downtimes. We consider a supply chain that consists of multiple subsystem providers whose decisions together determine system-level performance. We focus specifically on incentive implications of interdependent performance outcomes and the strategies to mitigate the inefficiencies that arise from it.

■ WA28

28- North 221 C- CC

Sustainable Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: David Drake, Assistant Professor, Harvard Business School, Morgan Hall 425, Boston, MA, 02163, United States of America, ddrake@hbs.edu

1 - Carbon Taxes and Supply Chain Emissions

Xi Chen, PhD Candidate, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, chen1644@umn.edu, Saif Benjaafar

We consider the carbon emissions of a supply chain consisting of one retailer and one or more suppliers. We show that imposing a tax on the emissions of each firm can paradoxically lead to higher supply chain emissions. We also show that collaboration does not always guarantee lower emissions. We then devise a tax scheme under which maximal emission reduction can be achieved with lower tax rates, and a collaboration scheme under which it is possible to simultaneously reduce emission and cost.

2 - Carbon-Optimal and Carbon-Neutral Supply Chains

Felipe Caro, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu, Charles Corbett, Tarkan Tan, Rob Zuidwijk

In this paper we explore the differences between making a supply chain carbon-neutral by offsetting all emissions vs. making it carbon-optimal by inducing all parties to invest appropriately in reducing GHG emissions. We examine conditions under which first-best can and cannot be achieved, and examine various decentralized outcomes.

3 - The Effect of Variability in Climate Policy on Facility Location and International Trade

Ozge Islegen, Northwestern University, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, o-islegen@kellogg.northwestern.edu, Terry Taylor, Erica Plambeck

One region imposes either a tax on GHG emissions or a cap-and-trade system in which the cost of a permit for emissions is uncertain and has mean equal to the tax. We show how variability in the permit cost affects the "leakage" of emissions, trade quantities, and social welfare in the region with climate policy under border adjustment and technology investment options.

4 - Carbon Tariffs: Effects in Settings with Technology Choice and Foreign Comparative Advantage

David Drake, Assistant Professor, Harvard Business School, Morgan Hall 425, Boston, MA, 02163, United States of America, ddrake@hbs.edu

When firms can choose from a set of potential production technologies and foreign firms hold a comparative cost advantage, I show that carbon leakage due to offshoring and/or foreign entry can result despite the implementation of a carbon tariff. However, in such a setting, carbon leakage is shown to conditionally decrease global emissions, contradicting prevailing popular opinion and widely reported results that do not account for technology choice or foreign comparative cost advantage.

■ WA29

29- North 222 A- CC

Emergency Operations

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14850, United States of America, sgh9@cornell.edu

1 - Modelling Ambulance Location and Deployment

Leanne Smith, Cardiff University, School of Mathematics, Cardiff University, Senghennydd Rd, Cardiff, CF24 4AG, United Kingdom, SmithL13@cardiff.ac.uk, Paul Harper, Vincent Knight, Janet Williams

Response time targets for the Welsh ambulance service (WAST) are not currently being met, particularly for high priority emergencies in rural areas. A discrete event simulation makes use of initial vehicle allocations from a developed location model, in order to identify the affect demand and numbers of available vehicles have on regional response. The research aims to assist waST in location, capacity and deployment decisions, so that they may provide a more efficient service to the population.

2 - Probabilistic Ambulance Location Model in a Time-dependent Environment

Pieter van den Berg, Delft University of Technology, Mekelweg 4, Delft, 2628 CD, Netherlands, P.L.vandenBerg@tudelft.nl, Karen Aardal

We study the ambulance location problem for emergency medical services (EMS). Although travel times and demand rates in general vary over the day, most ambulance location models are time-independent. We discuss a probabilistic location model with time-dependent travel times and demand rates, in which we maximize the expected coverage.

3 - EMS Team Planning: A Prediction and Evaluation Tool for Ambulance Services

Martin van Buuren, Scientific Programmer, Centrum Wiskunde & Informatica (CWI), Science Park 123, Amsterdam, 1098XG, Netherlands, M.van.Buuren@cwi.nl, Rob van der Mei

In a time of increasing cost reduction emergency medical service (EMS) providers are pressured to work more cost efficiently. In the meantime EMS providers aim for better medical service. EMS team planning (EMS-TP) enables EMS service providers to monitor their past performance, and moreover enables providers to predict call volumes and the number of ambulances needed at each base location for half an hour time intervals. EMS-TP is currently being deployed by a large Dutch EMS provider.

4 - Bounding the Performance of Ambulance Deployment Policies

Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14850, United States of America, sgh9@cornell.edu, Chaoxu Tong, Huseyin Topaloglu, Matthew Maxwell

We develop bounds on the response-time performance of ambulance deployment policies. The bounds are useful in determining whether additional resources are needed to reach performance targets, and in deciding when to stop refining policies. The bounds require the solution of a number of integer programs, and use comparison methods for queues. We describe the bounds and give representative results on two realistic but not real data sets for two different cities.

■ WA30

30- North 222 B- CC

Advances in Facility Location I

Contributed Session

Chair: Mustafa Canbolat, Assistant Professor, SUNY Brockport, 350 New Campus Drive, Brockport, NY, 14420, United States of America, mcanbola@brockport.edu

1 - Distributions of Rectilinear Deviation Distance to Point-like and Line-like Facilities

Masashi Miyagawa, University of Yamanashi, 4-3-11 Takeda, Kofu, 400-8511, Japan, mmiyagawa@yamanashi.ac.jp

An important criterion in flow demand location models is the deviation distance. The deviation distance is defined as the additional travel distance to visit a facility from pre-planned routes. In this paper, we derive the distribution of the rectilinear deviation distance. Facilities are approximated by points and lines of grid and random patterns. The distribution demonstrates how the shortest distance and the relative position of origin and destination affect the deviation distance.

2 - Algorithms for Locating K-obnoxious Facilities on a Plane

Utpal Bhattacharya, Assistant Professor, IIMI, Prabandh Sikhar, Indore, India, utpalb@iimidr.ac.in

In this paper k-obnoxious facility location problem has been modeled as a planar location problem. Two non linear programming iterative algorithms for k-obnoxious facility locations have been developed. First algorithm is a generalized iterative algorithm based on Drezner & Wesolowsky, (1983). Second algorithm is an enumerative iterative algorithm. Numerical example and relevant distinctness of the optimal solutions have been presented to illustrate the solution algorithms.

3 - Minimizing Emissions in Facility Location

Fan Jia, University of Minnesota, 111 Church Street S.E., Minneapolis, MN, 55455, United States of America, jiaxx049@umn.edu, John Carlsson

We consider a continuous facility location problem where the facilities are located according to the hub-and-spoke model and the objective function is to minimize total emissions produced by both the firm and the customers. Finding exact solutions to the problem is NP-hard. Thus we give a constant factor approximation algorithm for finding the emissions-optimal placement of facilities in any convex polygon.

4 - A Bi-objective Model for Locating a Semi-obnoxious Facility on a Transportation Network

Ruhollah Heydari, PhD Student, Northeastern University, MIE Depaetment, 360 Huntington Ave., Boston, MA, 02115, United States of America, Ruhollah.heydari@gmail.com, Emanuel Melachrinoudis

A new and more realistic model is introduced for the semi-obnoxious facility location problem. This model is composed of a weighted minisum function to represent the transportation costs on a network and a maximin function of elliptic distances between the new facility and the population centers to minimize the obnoxious effects of the facility. An algorithm is developed to find the efficient set of the bi-objective model and is implemented on a case study in the state of Massachusetts.

5 - Locating a Finite Size Barrier on the Plane with Expropriation

Mustafa Canbolat, Assistant Professor, SUNY Brockport, 350 New Campus Drive, Brockport, NY, 14420, United States of America, mcanbola@brockport.edu

We study the problem of locating a barrier facility in an area where interactions among existing points are present. The objectives are to minimize the interference of the barrier facility and to find a minimax location for the barrier facility. The problem is formulated as a bi-objective problem. A Simulated Annealing algorithm is presented for an extension of the problem where expropriation of existing facilities is also possible.

■ WA31

31- North 222 C- CC

Operations in Healthcare Applications

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Opher Baron, University of Toronto, 105 St George Street, Toronto, ON, Canada, Opher.Baron@rotman.utoronto.ca

1 - Optimal Portfolio Strategies for New Product Development

Mustafa Akan, Assistant Professor of Operations Management Tepper School of Business Carnegie Mellon University, Pittsburgh, PA, 152123, United States of America, akan@cmu.edu

We examine new product development (NPD) with scarce resources and many projects in parallel, each lasting several periods in the face of uncertainty. This study advances the NPD literature by revealing that optimal project selection and resource allocation decisions are congestion-dependent.

2 - Reducing Overcrowding in Emergency Departments using Information Sharing

Masha Shunko, Assistant Professor, Purdue University, 403 W. State St., West Lafayette, IN, 47907, United States of America, mshunko@purdue.edu, Alan Scheller-Wolf, Varun Gupta

While many emergency departments (EDs) in the U.S. experience overcrowding, ambulance crews often act independently and make decisions on where to route patients without any real-time information from the EDs. This independent decision-making approach may worsen the overcrowding situation. We analyze the value of information sharing between the EDs and ambulance crews; we show the characteristics of the EDs and arrival process that make the information sharing most valuable.

3 - Reducing Length of Stay in Hospital Emergency Rooms through Process Redesign

Lijie Song, MIT-Zaragoza International Logistics Program, Edificio Náyade, 5 C/ Bari 55, PLAZA, Zaragoza, 50197, Spain, lsong@zlc.edu.es, Thomas Lee, Tava Olsen, Esther Chen, Nicole DeHoratius

Point of care testing (POCT) is becoming increasingly popular in US hospitals as a way to speed up testing processes, reduce patient length of stay (LOS), and improve patient satisfaction. This study uses propensity score matching (PSM) combine with dif-in-dif analysis to test the impact of POCT versus central lab testing on patient LOS, using two years of data collected at a US hospital. We find a significant reduction in LOS for POCT patients; the reduction is not uniform across all patients.

4 - Using Strategic Idleness to Improve Customer Service Experience in Service Networks

Jianfu Wang, PhD Candidate, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S3E6, Canada, jianfu.wang08@rotman.utoronto.ca, Dmitry Krass, Opher Baron, Oded Berman

In service networks the perception of waiting depends on how it is distributed among different stations. To better capture customers' perception of service quality managers should consider the probability of long waits in each station. In a queueing network with several stations, a policy that allows idling may reduce the probability of long waits. We demonstrate the advantage of Strategical Idleness by applying Threshold Based Policies in a network with two single-server queues in tandem.

■ WA32

32- North 223- CC

Environmental Issues in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Gokce Esenduran, Ohio State University, College of Business, 656 Fisher Hall Fisher, Columbus, OH, 43210, United States of America, esenduran_1@fisher.osu.edu

1 - Impact of Downstream Competition on Innovation in a Supply Chain

Jingqi Wang, Northwestern University, Evanston, IL, United States of America, jingqi-wang@kellogg.northwestern.edu, Hyo duk Shin

We explore the impact of downstream competition on upstream innovation in a supply chain. We show that this impact depends on the contract form used in the industry. We also demonstrate that all firms within a supply chain can be better off by giving the supplier more channel power. Our findings have implications related to First Solar's recent challenge on how to encourage component manufacturer(s) to invest more on innovation.

2 - The Impact of Export Restrictions on the Implications of E-Waste Legislation

Isil Alev, Georgia Institute of Technology, Atlanta, GA, United States of America, isilalev@gatech.edu, Atalay Atasu, Vishal Agrawal

We explore the impact of export restrictions on manufacturer's design choices under e-waste take-back legislation, and their implications on manufacturer profits, consumer surplus and economic welfare in the exporting and importing countries.

3 - Approximation Balancing Policies for Inventory Systems with Remanufacturing

Sean Zhou, CUHK, Shatin, N.T., Hong Kong, Hong Kong-PRC, zhoux@se.cuhk.edu.hk, Zhijie Tao

We consider a single-product periodic-review inventory system with remanufacturable returned products. Demand and returns follow some general stochastic processes and may be correlated, non-stationary and evolving across different periods. We propose an approximation algorithm for computing manufacturing and remanufacturing quantities in each period and show that the expected cost under this approximation policy is at most twice of the optimal one.

4 - Remanufacturing under Warranty and Consumer Returns

Cerag Pince, Kuehne Logistics University, Hamburg, Germany cerag.pince@the-klu.org, Beril Toktay, Mark Ferguson

We consider a consumer electronics OEM selling a product and receiving consumer and warranty returns. The OEM can refurbish the consumer returns to sell in the refurbished market or to satisfy the warranty demand. warranty demand may also be satisfied by the new products. We investigate the optimal strategy for the OEM maximizing its profit and identify the optimal prices for new and refurbished products, and the optimal quantity for refurbished products that shall be used to satisfy warranties.

■ WA33

33- North 224 A- CC

Inventory Management for Perishable or End-of-Life Product

Contributed Session

Chair: Nils Buch, North Carolina State University, 400 Daniels Hall, Raleigh, NC, United States of America, nbuch@ncsu.edu

1 - Ordering Policies for Items with Residual-Life-Dependent Demand

Ozgun Caliskan Demirag, Pennsylvania State University- Erie, The Behrend College, 5101 Jordan Road, Erie, PA, 16563, United States of America, ozc1@psu.edu, Sanjay Kumar

Customer demand for some products may decrease as they approach the end of their useful life. Using deterministic model settings, we explore ordering policies that explicitly consider the dependence of demand on residual-life. Proposed models are shown to generate higher profits when compared to traditional policies.

2 - An Inventory Replenishment Model with Multiple Delivery Modes

Cinthia Perez, Research Assistant, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, Fl, 32611, United States of America, ccperez@ufl.edu, Joseph Geunes

We consider a single-stage inventory replenishment model with multiple delivery modes with different lead time distributions and costs. The presence of highly responsive, reliable modes permits delaying reorder decisions for these modes until some information about the lead time performance of less reliable modes is known. Using a simulation-based optimization model, we characterize the value of multiple delivery mode options under various risk measures and service levels.

3 - The Effect of Contracts on End-of-Life Spare Parts Acquisition

Nicholas Leifker, Assistant Professor, St. John Fisher College, 3690 East Ave., Rochester, NY, 14618, United States of America, nleifker@sjfc.edu, Timothy Lowe, Philip Jones

In end-of-life spare parts acquisition, a 'final order' of spare parts is ordered to satisfy future demand; the goal is to find the optimal order amount. We look at multiple models based on the actions taken once the final spare parts order has run out - specifically, whether or not replenishment at a premium cost is possible. Based on these models, we will then examine the effect of contractual issues within the last buy, such as the use of contract extensions and contract pooling.

4 - An Inventory Model with Multiple Replenishment Opportunities and Late-Season Markdowns

Nils Buch, North Carolina State University, 400 Daniels Hall, Raleigh, NC, United States of America, nbuch@ncsu.edu, Russell E. King, Anita Vila-Parrish, Donald Warsing

We present a multi-period, finite-horizon model with unknown demand distribution parameters in each period, and the possibility for late-season markdowns. We characterize the policy structure of the model, and demonstrate insights into the value of additional replenishment opportunities, with and without late-season markdowns, where replenishment has no explicit fixed cost. We demonstrate that additional orders reduce the sensitivity of expected profit to initial forecast inaccuracy.

■ WA34

34- North 224 B- CC

Transportation and Shipping I

Contributed Session

Chair: Martijn Mes, Assistant Professor, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.r.k.mes@utwente.nl

1 - A Simulated Annealing Heuristic for Location Routing Problem with Simultaneous Pickup and Delivery

Shin-Yu Lin, National Taiwan University of Science and Technology, No.8, Ln. 214, Shidong Road, Shilin District, Taipei City, 111, Taiwan-ROC, wvbweril@yahoo.com.tw, Vincent F. Yu

This study concerns with the location routing problem with simultaneous pickup and delivery (LRPSPD), a variant of the location routing problem. The main difference between the two problems is that, in the LRPSPD, each customer has both pickup and delivery demands that need to be satisfied simultaneously. We propose a simulated annealing (SA) heuristic for the LRPSPD. Computational results indicate that the proposed SA heuristic is competitive with existing approaches.

2 - A Rolling Horizon Model for Scheduling Two Non-passing Yard Cranes in a Container Stack

Amir Hossein Gharehgozli, Research Associate, Rotterdam School of Management, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, agharehgozli@rsm.nl

Container stacks at a container terminal decouple different transport modes in time. Avoiding reshuffles, selecting storage locations and scheduling containers that should be stacked in or retrieved from the stacks is instrumental in minimizing throughput times at such terminals. Nowadays, terminal operators use two cranes to carry out these stacking operations in each stack. We study how to schedule two non-passing cranes with practical constraints and the objective of minimizing the makespan.

3 - Transportation Cost Allocation on a Fixed Route

Lei Sun, University at Buffalo, SUNY, 308A Bell Hall, Buffalo, NY, 14260, United States of America, leisun@buffalo.edu, Mark Karwan, Jose Pinto, Atul Rangarajan

We consider a transportation cost allocation problem on a fixed route in which the routing to all customers for any subsets of customers may not be optimal. For the objective, seven geometric location related fairness criteria are introduced. We examine two existing cost allocation methods and propose a new solution scheme to address these complications based on cooperative games and heuristics. A computational study demonstrates its advantages on the fairness criteria and on a real application.

4 - BATMAN: Barge Terminal Multi-Agent Network

Martijn Mes, Assistant Professor, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.r.k.mes@utwente.nl

We consider the barge rotation planning and quay scheduling problem in the Port of Rotterdam. This problem concerns the alignment of barge rotations and terminal quay schedules. We use a Multi-Agent based system because it mirrors to a large extent the way the business network is currently organized and provides an acceptable solution for each of the actors involved. We illustrate the applicability of our approach using simulation and an implementation project within the Port of Rotterdam.

5 - Prioritizing Replenishments of the Forward Reserve Area

Rommert Dekker, Prof. Operations Research, Erasmus University Rotterdam, Burg. Oudlaan 50, Rotterdam, Netherlands, rdekker@ese.eur.nl, Harwin de Vries

Having sufficient inventories in the piece-picking area of a warehouse is an essential condition for warehouse operations. This requires a timely replenishment of the products from a reserve area. In this paper we develop analytical models to arrive at priority rules for these replenishments in case replenishments and order picking are done simultaneously because of time pressure. The priority rules are compared by means of simulation and regression.

■ WA35

35- North 225 A- CC

Algorithms to Solve Practical RM Problems

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Gustavo Vulcano, Associate Professor, New York University, 44 West Fourth St., Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu

1 - On the Approximate Linear Programming Approach for Network Revenue Management

Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu, Chaoxu Tong

One way to obtain bid prices for network revenue management problems involves using the approximate linear programming approach on the dynamic programming formulation of the problem. This gives a linear program whose number of constraints increases exponentially with the number of flights. So, the linear program is solved via column generation on the dual. We show how to a priori reduce the number of columns to a polynomial size, potentially eliminating the need for column generation altogether.

2 - Pricing under General Choice

Srikanth Jagabathula, New York University, Kaufman Management Center, 44 W 4th Street, Rm 8-74 KMC, New York, NY, 10012-1126, United States of America, sjagabat@stern.nyu.edu

We consider the problem of optimal pricing for a given assortment of products when the demand is determined by a nonparametric choice model. We assume we are given historical transaction data. The choice model is assumed to be a distribution over preference lists and the choice probability is assumed to be related to the price through a logistic function. The talk will present the results on the optimal price structure under these conditions.

3 - Models for Air Cargo Revenue Management

Joern Meissner, Professor, Kuehne Logistics University, Brooktorkai 20, Hamburg, 20457, Germany, joe@meiss.com, Kevin Glazebrook, Emily Cookson

Air cargo revenue management can be described as the integrated management of aircraft cargo weight and volume constraints and chargeable cargo rates. The Air Cargo industry faces some unique challenges: Highly volatile demand, weight/volume uncertainty through variable tendering and very short booking cycles are some of the features. We develop a new dynamic programming formulation with potential to aid an air cargo company to maximize its expected profit under these challenges.

4 - Computing Revenue Management Controls under Uncertain Capacity

Gustavo Vulcano, Associate Professor, New York University, 44 West Fourth St., Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Alex Weil

We consider a RM problem where the final capacities are uncertain while the airline takes bookings. The controller sets a virtual capacity and a bid-price for each of the resources at the beginning of the horizon, and collects revenues by accepting or rejecting requests. The effective capacity is realized at the end of the horizon and potentially not all ticketed passengers could be accomodated, leading to a penalty cost. We present a stochastic gradient algorithm to address this problem.

■ WA36

36- North 225 B- CC

Pricing in the Presence of Promotional Effects

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Goker Aydin, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, ayding@indiana.edu

1 - The Effect of Online Consumer Reviews on Firm Pricing Strategies

Necati Tereyagoglu, Assistant Professor, Georgia Institute of Technology, College of Management, Atlanta, GA, United States of America, necati.tereyagoglu@scheller.gatech.edu

We investigate the change in pricing decisions of a seller after the availability of online consumer reviews in a market. The seller sells a good to a market with heterogeneous consumers in terms of their preferences and expertise over two periods. We show that the firm may charge a premium in advance and strategically decrease the price afterwards with the availability of the consumer reviews despite the lack of informed consumers in the market.

2 - Designing Government Feed-In-Tariff Policies to Promote Green Technologies

Saed Alizamir, PhD Student, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, saed.alizamir@duke.edu, Francis de Vericourt, Peng Sun

Incentive policies such as Feed-In-Tariff (FIT) are used by governments to promote green technologies toward market integration. In this paper, we model the widespread of a new green technology and the contributing factors such as learning curve and diffusion process, using a dynamic program. We study the optimal design of FIT policies and gain insights into how the government should dynamically adjust the prices or tariff levels as the technology grows.

3 - Returns Policies between Channel Partners for Durable Products with used Goods Markets

Mehmet Gumus, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, mehmet.gumus@mcgill.ca, Saibal Ray, Shuya Yin

Many durable products with relatively short selling seasons have been using returns policies between manufacturers and retailers as contractual protocol for quite some time. More recently, these sectors have witnessed the emergence of online used goods markets as important transaction channels. Given that these two issues are linked, in this work, we study the role of the used goods market in shaping a manufacturer's incentive to offer a returns policy option to a retailer.

4 - Sponsored Search Marketing: Dynamic Pricing and Advertising for an Online Retailer

Shengqi Ye, Doctoral Student, Indiana University at Bloomington, 1309 E. 10th Street, Bloomington, IN, 47405, United States of America, shye@indiana.edu, Goker Aydin, Shanshan Hu

Many online retailers rely on search engine marketing, i.e., paying a search engine to promote the retailer's website. We consider an online retailer that dynamically updates its price as well as its ad spending. We show that the retailer's ability to update its ad spending may have surprising effects on the retailer's optimal pricing. For example, larger inventory levels might lead to higher prices, if such inventory levels also encourage aggressive ad spending.

■ WA37

37- North 226 A- CC

Location Objectives II

Sponsor: Location Analysis

Sponsored Session

Chair: Zvi Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu

1 - A Location-allocation Problem with Concentric Circles

Jack Brimberg, Professor, Royal Military College, Kingston, ON, Canada, jack.brimberg@rmc.ca, Zvi Drezner

Consider a problem where a set of fixed points (customers) in the continuous plane is given and each of these points has an associated positive weight (or demand). The objective is to locate p concentric circles and allocate the fixed points to them in order to minimize the sum of weighted distances from the fixed points to their closest circles. This new model is described, its properties examined, and heuristic solution methods are proposed. Applications of the model are explored.

2 - Placement of Two Finite-size Facilities in an Existing Layout with the Rectilinear Distance Metric

Rakesh Nagi, Professor, University at Buffalo, 438 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 14260, United States of America, nagi@buffalo.edu, Ketan Date

We consider the optimal placement of two finite size rectangular facilities, in presence of existing rectangular facilities, and rectilinear travel. Three types of interactions are considered between boundary I/O points of: (1) new facilities and existing facilities; (2) pairs of existing facilities; and (3) two new facilities. We identify the candidates for optimal placement of the two new facilities which will minimize the sum of the weighted distances between the interacting facilities.

3 - Sequential Location of Two Facilities: Where to Locate the First Facility?

Tammy Drezner, Professor, California State University, Department of ISDS, Fullerton, CA, 92834, United States of America, tdrezner@fullerton.edu, Zvi Drezner

We investigate locating two facilities. The best strategy is to locate them optimally. When there is no efficient way to find the optimal solution to the problem, the facilities can be located sequentially. We investigate whether it is better to locate the first facility at its single facility optimal location or at a random location.

4 - Big Triangle Small Triangle Method for the Estimation of Parameters of Probability Distributions

Atsuo Suzuki, Professor, Nanzan University, 27 Seirei-cho, Seto, Japan, atsuo@nanzan-u.ac.jp

We apply the Big Triangle Small Triangle (BTST) algorithm for the estimation of the parameters of probability distributions such as the logistic distribution. The maximum likelihood method is common method to estimate the parameters of the distribution. However, a likelihood function is not necessary concave. That means the likelihood function has many local maxima. To find the maximum of the likelihood function, we resort the BTST algorithm.

■ WA38

38- North 226 B- CC

Air Transportation Service Science

Sponsor: Service Science

Sponsored Session

Chair: Johnathon Dulin, Concurrent Technologies Corporation, 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com

1 - Jet In, Jet Out, Jet Going! Reducing Air Travel Delays through the Use of Wayports

Ashlee Knapp, Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15904, United States of America, knappa@ctc.com, Johnathon Dulin

In 2010, the Philadelphia and Newark airports had more than 63 million customers and were among the nation's worst for on-time performance. With over 40% of these being connecting passengers, what overall air traffic efficiency gains could be achieved if some of the 25 million superfluous travelers were removed from these bottleneck locations? Here we describe our initial efforts aimed at assessing the impact of using an alternative airport in the region as a wayport for connecting customers.

2 - Air Cargo Pickup and Delivery Problem with Alternative Access Airports

Farshid Azadian, PhD Candidate, Wayne State University, 4815 Fourth St., Detroit, MI, 48201, United States of America, f_azadian@wayne.edu, Ratna Babu Chinnam, Alper Murat

This study considers a freight forwarder's operational implementation of alternative access airport policy in a multi-airport region for air cargo transportation. This problem is formulated as a novel pickup and delivery problem, where the delivery cost is both destination and time dependent. An efficient solution method based on Lagrangian decomposition and variable target method with backtracking is developed.

3 - Assessing the Use of Alternative Aircraft Vehicles to Address Future Capacity Shortfalls

Jeremy Eckhause, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States of America, jeckhause@lmi.org, Yuri Gawdiak, George Price, Robert Hemm

The Strategy, Architecture and Analysis Division of NASA's Aeronautics Research Mission Directorate (ARMD SAA) evaluated several NextGen alternatives for the state of the air transportation system in 2025. To address potential capacity shortfalls at some airports, ARMD SAA analyzed the potential benefit of accommodating unsatisfied demand through the use of Civil Tiltrotor (CTR) and Cruise-Efficient Short Takeoff and Landing (CESTOL) aircraft. Methodology and performance results are presented.

■ WA39

39- North 226 C- CC

OM-Marketing Interface: Pricing I

Contributed Session

Chair: Ahmad Bajwa, Doctoral Student, The University of Alabama, 300 Alston Hall, The University of Alabama, Tuscaloosa, AL, 35487, United States of America, anbajwa@crimson.ua.edu

1 - Product Assortment and Pricing in the Presence of Retail Competition and Store Brands

Bo Liao, PhD Candidate, Haas School of Business, Haas School of Business, F402, Berkeley, 94720, United States of America, bo_liao@haas.berkeley.edu, Candace Yano

We study retailers' equilibrium strategies regarding store brand offering and pricing of both store- and competing national brand products under asymmetric competition and implications for the national brand manufacturer. We show that the national brand manufacturer's pricing decision, which affects which retailers offer his product, depends on the quality gap between store brands. Although symmetric retail competition benefits the manufacturer, disparate store brand quality hurts him.

2 - Optimal Pricing of Two Successive-Generation Products with Trade-in Options under Uncertainty

Rui Yin, Assistant Professor, Arizona State Unviersity, Dept. of Supply Chain Mgmt, W. P. Carey School of Business, Tempe, AZ, 85284, United States of America, rui.yin@asu.edu, Hongmin Li, Christopher Tang

We present a two-period model in which a firm sells two successive generations of a product to forward-looking customers. A trade-in program is offered which allows buyers of the first-generation product to trade-in the product and upgrade to the new product at a discounted price. We examine the implications of certain model parameters on the firm's optimal prices, profit and the effectiveness of the trade-in program.

3 - On the Roles of Price Negotiation and Extended Warranty in a Distribution Channel

Hsing-Ping Kuo, University of North Carolina at Chapel Hill, 300 Kenan Center Drive, Chapel Hill, NC, 27599, United States of America, hpkuo@unc.edu, Chia-Wei Kuo, Kwei-Long Huang, Jiun-Yu Yu

We consider a manufacturer sells a product through a retailer. The retailer determines the pricing policy – posted pricing or negotiation, and whether to bundle the product with extended warranty. Our result shows pricing policy has significant effect on whether the retailer bundles the product with extended warranty.

4 - Pricing Multiple Products with Setup Costs and Capacity Constraints

Ahmad Bajwa, Doctoral Student, The University of Alabama, 300 Alston Hall, The University of Alabama, Tuscaloosa, AL, 35487, United States of America, anbajwa@crimson.ua.edu, Charles Sox

We consider dynamic problem of pricing multiple products for a profit maximizing firm. We include capacity constraints, setup costs, and seasonality. Our approach can be used for constant pricing, as well as dynamic pricing, and is applicable for linear as well as nonlinear demand functions. We use real-world data and solve for optimal prices. We show that optimal prices may change in unpredictable and counter-intuitive directions. We discuss when dynamic pricing is better than constant pricing.

■ WA40

40- North 227 A- CC

Joint Session ENRE-Env & Sustainability/Energy: Energy and Environment

Sponsor: Energy, Natural Res & the Envi/ Environment and Sustainability & Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Taraneh Sowlati, University of British Columbia, Department of Wood Science, Faculty of Forestry, Vancouver, BC, V6T 1Z4, Canada, Taraneh.Sowlati@ubc.ca

1 - Comparison of Current and Proposed U.S. Energy Policies with an Equivalent Carbon Tax

Kemal Sarica, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, ksarica@purdue.edu, Wallace Tyner

The purpose of the study is to compare the current US climate policy Clean Energy Standard for electricity, Renewable Fuel Standard for biofuels, and Corporate Average Fuel Economy (CAFE) standard with carbon tax. We make use of EPA MARKAL model which has been extensively modified by adding land supply from GTAP for biomass, biochemical and thermochemical conversion technologies for cellulosic fuels, new shale gas incorporated natural gas supply curves, and accurately modeling the CAFE standard.

2 - A Model for Tactical Value Chain Optimization of a Wood Biomass Power Plant with Uncertainty

Nazanin Shabani, University of British Columbia, Vancouver, BC, Canada, nshabani@interchange.ubc.ca, Taraneh Sowlati

This paper presents an optimization model to maximize the overall value of the supply chain of a typical forest biomass power plant with uncertainty. It considers biomass procurement, storage, energy production and ash disposal in an integrated framework at the tactical level. The nonlinear mixed integer programming model is solved using an outer approximation method. The developed model is applied to a real case biomass power plant and uncertainties are considered using different scenarios.

3 - The End of California's Oil Rigs: Decision Analysis Finds a Win-win Solution

Surya Swamy, Consulting Decision Analyst, Lumina Decision Systems, 26010 Highland Way, Los Gatos, Ca, 94117, United States of America, surya@lumina.com, Max Henrion

Controversy arose about how to decommission California's 27 offshore oil and gas platforms, now at the end of their productive lives. The California Ocean Sciences Trust (OST) sponsored a study to evaluate options, including complete removal and converting rigs to artificial reefs. A multi-attribute decision analysis framework using Analytica assisted stakeholders, including fishermen, divers, oil companies, and state agencies, resulting in an innovative solution preferred by most stakeholders.

■ WA41

41- North 227 B- CC

Applications in Underground Mining

Sponsor: Energy, Natural Res & the Environment/Mining

Sponsored Session

Chair: Donal O'Sullivan, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, dosulliv@mines.edu

1 - Optimized Underground Production Scheduling with Ventilation Constraints

Andrea Brickey, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, abrickey@mymail.mines.edu

Underground mines have been subjected to increasing restrictions on diesel particulate matter associated with the exhaust produced by the internal combustion engines of diesel-fueled mining equipment. We present a mixed integer nonlinear optimization model to schedule production for a large-scale underground gold mine with the objective of maximizing discounted metal extraction. Constraints include typical (linear) precedence and resource capacities, and also incorporate nonlinear air flow.

2 - Long-term Extraction and Backfill Scheduling in a Complex Underground Mine

Donal O'Sullivan, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, dosulliv@mines.edu, Alexandra Newman

We use an integer programming model to optimize production at a complex underground mining operation. Mine managers seek to maximize metal production while using a mixture of mining methods to extract the ore. We apply a sliding time window heuristic to solve for a four year schedule with weekly fidelity.

3 - Practical Guidelines for Solving Hard Linear and Mixed Integer Programs

Alexandra Newman, Associate Professor, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, anewman@mines.edu, Ed Klotz

Advances in hardware and software have enabled the efficient solution of many large-scale linear (integer) programs. However, many real-world linear and linear integer programs can still require days of run time and are not guaranteed to yield a near-optimal solution. We present suggestions for diagnosing and removing performance problems in commercially available solvers, and guidelines for careful model formulation, drawing on examples from the mining and energy industries.

■ WA42

42- North 227 C- CC

Transportation Operations for Express and Transit Vehicles

Contributed Session

Chair: David Czerwinski, San Jose State University, One Washington Square, San Jose, CA, 95192-0069, United States of America, david.czerwinski@sjsu.edu

1 - A Rule-based Routing Algorithm in Express and Logistics Industry

Yongqing Xue, IBM Research - China, Building 19, 8 Dongbeiwang WestRoad, Beijing, China, yqxue@cn.ibm.com, Dingding Lin, Li Zhang

With the increasingly fierce competition, each express and logistics company has to strengthen business management and improve service quality. Routing and scheduling large amount of shipments efficiently is a core problem for express and logistics companies. This paper introduces a rule-based routing algorithm, which is based on trunk transfer rules, facility hierarchy and some special transfer rules, combining with the depth-first algorithm.

2 - LNG Shipping Fuel Reduction by Optimal Fleet Allocation

Hiroki Kobayashi, officer, osakagas, chuouku hiranomati, 4-1-2, osaka, os, 5410046, Japan, hiro-kobayashi@osakagas.co.jp

One way to lower the cost of city gas, there is a reduction of Shipping costs. It is possible to reduce it, only when LNG tanker travel at a moderate speed. However, it is difficult to do it because there is a need to go to a predetermined location and day. In this report, we show the potential reduction of fuel by assigning optimally as the ship fleet.

3 - Agent-based Simulation and Optimization of Urban Transit System

Guangzhi Zhang, PhD Student, Department of Industrial Engineering, Tsinghua University, Room 607, Shund Building, Tsinghua University, Beijing, 100084, China, zgz07ie@gmail.com, Han Zhang, Lefei Li

To better solve the passenger assignment problem in transit network optimization problem, we build an Artificial Urban Transit System (AUTS) and propose a Day-to-Day Learning Mechanism to describe passengers' route and departure time choice behaviors. With the support of AUTS to handle the lower level problem, we solve the upper level of transit network design model. Comparing with other bi-level models, this better accommodates passengers' dynamic learning behavior and their heterogeneity.

4 - Last Mile Transportation Operation and Management for Express Delivery Enterprises

Xiaoqing Wang, IBM Research-China, Building 19, 8 Dongbeiwang West Road, Beijing, China, xqwangxq@cn.ibm.com, Hongwei Ding, Wei Wang, Yongqing Xue, Dingding Lin, Li Zhang

Last mile transportation is often expensive and less effective for express delivery enterprises, which describes the movement of express from a transport hub to a final destination. This paper surveyed current operation and management status of last mile transportation for express delivery enterprises. The classification, operation process and management key points of last mile transportation are introduced, analyzed and studied.

5 - Assessing the Accuracy of Transit Vehice Arrival Time Predictions

David Czerwinski, San Jose State University, One Washington Square, San Jose, CA, 95192-0069, United States of America, david.czerwinski@sjsu.edu

Many transit agencies now provide real-time predictions of vehicle arrival times. In this project, we analyze the accuracy of the predictions at a large transit operator. Using data collected from the Chicago Transit Authority's Bus Tracker website, we assess the impact of several factors on prediction accuracy. Factors include time of day, day of week, location of the stop along the route, headway, and direction. Implications for improving the accuracy of predictions are also discussed.

■ WA43

43- North 228 A- CC

Studies on Shared Corridors

Sponsor: Railway Applications

Sponsored Session

Chair: Xuesong Zhou, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Use of Socio-Technical Roadmapping in Transportation Infrastructure Planning

Scott Grasman, Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, segeie@rit.edu, Suzanna Long

This research creates a socio-technical roadmap for transportation infrastructure as part of a study that was used to create the Missouri State Rail Plan. The roadmap illustrates partnerships, processes, and infrastructure that comprise the socio-technical elements of a strategic rail network and showcases short-, medium-, and long-range planning decision points.

2 - Identifying and Prioritizing Shared Rail Corridor Technical Challenges

Rapik Saat, Research Assistant Professor, University of Illinois at Urbana-Champaign, 205 N Mathews, Urbana, IL, 61801, United States of America, mohdsaat@illinois.edu, Brennan Caughron, Christopher Barkan

New passenger and high-speed rail developments in the U.S. may involve infrastructure sharing with existing freight railroads. It is important to safely and effectively accommodate any new passenger service while sustaining ongoing freight rail transportation efficiency and growth. This study identified important technical challenges, knowledge gaps and research needs related to shared freight and passenger rail corridors.

3 - Auction Pricing of Network Access for North American Railways

Steven Harrod, Assistant Professor, University of Dayton, 300 College Park, Dayton, OH, 45469, United States of America, steven.harrod@udayton.edu

An auction process is suggested as necessary to maintain transparency in the pricing of rail network "open access". Multiple random samples of auction pricing for a single track railway line demonstrate that the infrastructure entity will receive approximately 15.6% less than the true value of the contracted train paths. This loss of revenue threatens the objective of reducing government subsidy for the railway network.

4 - Maintenance Scheduling for Shared Freight and Passenger Rail Corridors

Brennan Caughron, University of Illinois at Urbana-Champaign, 205 N Mathews, Urbana, IL, 61822, United States of America, bcaughr2@illinois.edu

Railroad maintenance windows can be scheduled with the goal of minimizing delay to traffic; however this objective often conflicts with the alternate goal of maximizing maintenance productivity and minimizing cost. This study will review past work in the area of maintenance window scheduling and identify challenges and potential areas for future research specific to shared freight and passenger rail corridors.

■ WA44

44- North 228 B- CC

Supply Chain: Applications with Risk Management

Contributed Session

Chair: Fernando Oliveira, Professor, ESSEC Business School, 13-02 National Library Building, 100 Victoria St, Singapore, 188064, Singapore, oliveira@essec.edu

1 - Robust Optimization for Fuel Supply Chain

Anna Danandeh, PhD Student, University of South Florida, 11309 N 50th St. Apt #8, Tampa, 33617, United States of America, annadanandeh@mail.usf.edu, Bo Zeng, Brent Caldwell

We consider a multi-period supply chain model which includes quality, heterogeneous unit specifications, environmental requirements and transportation issues. In order to capture uncertainties in those components, a robust formulation is proposed and some numerical results are presented to show the effectiveness of this model.

2 - Emergent Inventory under Asymmetric Demand and Supplier's Yield Uncertainty Information

Huili Zhang, Xi'an Jiaotong University, West Xianning Road N.O.28,2229#, Xi'an, China, huili.zhang86@gmail.com, Linglang Tang, Yinfeng Xu

We study a supply chain with a supplier(S) and a manufacture (M). The supplier's yield is uncertain for the disasters, e.g. earthquake and tsunami. S decides the selling price to M while M makes the decision on the order quantity by the stochastic demand and the supplier's yield uncertainty. We will check the impact of the different levels of asymmetric information on the decisions, both with and without salvage value change which is depended on proportion of the fulfilled order quantity.

3 - Vendor-managed Inventory Contract in a Decentralized Assembly System under Supply Uncertainty

Wenting Pan, Saint Mary's College of California, 380 Moraga Road, Moraga, 94556, United States of America, wp3@stmarys-ca.edu

We consider a decentralized two-component assembly system. One of the components is subject to random yield. The assembler designs a VMI-revenue sharing contract, where the assembler offers to pay the suppliers for each assembled and sold component. Based on the offered prices, the two suppliers decide on the production quantities. Under this contract, we study the minimum price the assembler needs to provide and the optimal suppliers' quantity and assembler's pricing decisions.

4 - Horizontal Collaboration Without Transfer Payments: Defining Operational Rules to Hedge Uncertainty

Alejandro Lamas, Université Catholique de Louvain, Place des Doyens 1, Louvain-la-Neuve, Belgium, Louvain-la-Neuve, N/, 1348, Belgium, alejandro.lamas@uclouvain.be, Philippe Chevalier

We address the problem of the production plan of two agents under a horizontal collaboration over multi-production intervals. Individually, each agent faces a Capacitated Lot Sizing problem. Under collaboration, production capacities can be shared in order to gain from economies of scale. We propose a novel approach which goal is to decide on a production plan maximizing the benefits of collaboration while satisfying the individual rationality constraints without transfer payments.

5 - Optimal Rationing Policy for Inventory Systems with Multiple Demand Classes and Backordering

Jianjun Xu, Postdoc Researcher, Zaragoza Logistics Center, C/ Bari 55, Edificio Náyade 5 (PLAZA), Zaragoza, 50197, Spain, Youyi Feng

We study a periodic review inventory system with multiple demand classes. A single product is replenished in each period with a leadtime. The manager has to decide how to ration the inventory among different demand classes. Unsatisfied demand is backlogged. We use structural properties to analyze the optimal ordering and rationing policy.

■ WA45

45- North 229 A- CC

Joint Session MI/HAS: Designing Web and Social Media Experiences to Address Health Disparities

Sponsor: Minority Issues & Health Applications Society

Sponsored Session

Chair: Fay Cobb Payton, Associate Professor, North Carolina State University, COM, Box 7229, Raleigh, NC, 27695, United States of America, fcpayton@ncsu.edu

1 - Lessons Learned: Designing an IT Artifact While Creating a Health Experience

Fay Cobb Payton, Associate Professor, North Carolina State University, COM, Box 7229, Raleigh, NC, 27695, United States of America, fcpayton@ncsu.edu, Khalia Braswell, Jeremy Currence, Kamar Galloway

In developing a website for African-American women that advocates prevention and awareness for HIV/AIDS, three things are important to consider: social media integration, tracking the social mushroom, and branding the user experience. As research scholars, we use a participatory design process to pinpoint the specific health needs of the African-American female community.

2 - Stigma Entrusted Institutions and HIV/AIDS: The Role of Family, Churches, and Medical Institutions

Johanne Laboy, Graduate Student, NC State U, Department of Communication, 201 Winston Hall, Raleigh, NC, 27695, United States of America, laboy@nc.rr.com, James Kiwanuka-Tondo, Fay Cobb Payton

One of the major challenges of HIV/AIDS interventions is stigma experienced by afflicted and affected family members. This paper analyzes the role played by family members, churches, and medical institutions in this complex issue.

3 - Theoretical Approaches to Public Health: Women and HIV

Jing Chong, Post-Doctoral, Pennsylvania State University, IST Building, University Park, PA, 16802, United States of America, chongjing79@gmail.com, Lynette Kvasny

In order for women to gain more knowledge from the HIV/AIDS prevention information on government health websites and obtain the desired behavior change, they need to be able to find the information and need to receive culturally relevant information. In this paper, I will review the literature in public health education and communication strategies, and health-related information behavior. I will then develop a theoretical framework that synthesizes concepts from this literature.

4 - Human Computer Interaction Frameworks: Challenges Associated with Designing myHealthImpact.org for HIV Dissemination

Christina Harrington, Graduate Student, NC State U, Raleigh, NC, 27695, United States of America, cnharrin@ncsu.edu, Fay Cobb Payton

Current research trends highlight social implications as a research framework in user interface design. However, there is a need for a more human-centered design method to address consumer needs of certain social populations. Informed by focus-group data collected to develop a HIV/AIDS awareness website, this research aims to discuss current HCI frameworks in relevance to the needs of an identified user population.

■ WA46

46- North 229 B- CC

Game Theory I

Contributed Session

Chair: Sam Ganzfried, PhD Candidate, Computer Science Department, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sganzfri@cs.cmu.edu

1 - Strategy Purification and Thresholding: Effective Non-Equilibrium Approaches for Playing Large Games

Sam Ganzfried, PhD Candidate, Computer Science Department, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sganzfri@cs.cmu.edu, Tuomas Sandholm, Kevin Waugh

The leading approach to imperfect-information games is to compute an equilibrium in an abstraction. Our new approach modifies action probabilities by preferring the higher-probability actions. This leads to stronger play. We won the no-limit bankroll division of the 2010 Computer Poker Competition. We also show gains in random matrix games. The approach achieves robustness against overfitting the strategy to the abstraction. The gains do not necessarily come at the expense of exploitability.

2 - Computation of Perfect Equilibria for a Finite n-Person Game in Normal Form

Chuangyin Dang, Professor, City University of Hong Kong, Departmentof Systems Engineering, 83 Tat Chee Avenue, Kowloon, Hong Kong-PRC, mecdang@cityu.edu.hk, Yin Chen

For any given positive number epsilon, we show that the imposition of a minimum probability epsilon on each pure strategy in a Nash equilibrium leads to an epsilon-perfect equilibrium of a finite n-person game in normal form. As an application of this result, we derive a scheme to compute a perfect equilibrium by means of an interior-point path-following method.

3 - Finding Equilibria in Supermodular Games

Qi Qi, Assistant Professor, Hong Kong University of Science and Technology, Department of IELM, Kowloon, Hong Kong-PRC, kaylaqi@ust.hk, Chuangyin Dang, Yinyu Ye

A supermodular game abstracts relations in the players' strategic alternatives, among the participation agents. Tarski's fixed point on lattices forms the mathematical foundation for the supermodular game. For both supermodular games and Taski's fixed points, we find the first efficient algorithm to find one solution and prove hardness results to determine uniqueness.

4 - Lossy Stochastic Game Abstraction with Bounds

Tuomas Sandholm, Carnegie Mellon University, Computer Science Dept, Pittsburgh, PA, United States of America, sandholm@cs.cmu.edu, Satinder Singh

Abstraction followed by equilibrium finding has emerged as a leading approach to solving games. Lossless abstraction typically yields games that are still too large to solve, so lossy abstraction is required. We develop a framework that enables the design of lossy game abstraction algorithms with guarantees on solution quality; it handles state and action abstraction. We design the first such algorithms. We prove abstraction NP-complete; this does not mean it is too hard in practice.

5 - Safe Opponent Exploitation

Sam Ganzfried, PhD Candidate, Computer Science Department, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sganzfri@cs.cmu.edu, Tuomas Sandholm

Consider the problem of playing a finitely-repeated zero-sum game while guaranteeing at least the value of the game in expectation. Prior work conjectured it is impossible to simultaneously deviate from a stage-game equilibrium (in hopes of exploiting a suboptimal opponent) and to guarantee safety. We show this is false. We give a full characterization of safe strategies, and develop efficient algorithms for exploiting suboptimal opponents safely. We validate this with experiments on Kuhn poker.

■ WA47

47- North 230- CC

Traffic Assignment and Applications

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu

1 - The Combined Distribution and Stochastic Assignment Problem with Distance Constraints

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, Shoupeng Tang, Nan Jiang

This paper represents a combined distribution and stochastic assignment model which is developed for destination and route choice among two kinds of trips. One kind of the trips is traveled by gas vehicles which will be assigned to all destinations and all reasonable paths, and the other is traveled by electric vehicles which are subject to distance constraints. For both types of trips, the travel demand will be allocated to destinations and paths according to principles of distribution and stochastic user equilibrium. A solution algorithm for the model is developed.

2 - Tradable Emission Credits in Stochastic user Equilibrium with Heterogeneous Users: A Market-based Approach to Achieve Air Quality Standards

H.M. Abdul Aziz, PhD Student, Purdue University, 150 Arnold Drive, Apt15, West Lafayette, IN, 47906, United States of America, haziz@purdue.edu, Satish Ukkusuri

This research proposes a market based approach for meeting the air quality standards in transportation networks. The externality due to emission is compensated through emission credits (initially distributed among the system users). A stochastic user equilibrium based model (with heterogeneous users) is developed and the existence of unique equilibrium credit price is proved. Finally, a solution algorithm is provided to implement the credit-based scheme in large transportation networks.

3 - Optimal Tolls for Converting General Purpose Lanes to High Occupancy Toll (HOT) Lanes

Chaitanya Paleti, Purdue University, West Lafayette, ID, United States of America, cpaletis@purdue.edu, Srinivas Peeta, Sushant Sharma

HOT lanes have a potential to generate revenue and relieve congestion. This has encouraged conversion of general purpose lanes into HOT lanes. In this study, we propose a methodology using agent based modeling for designing optimal tolls for HOT lanes by factoring the travel time and equity issues.

4 - A New User Equilibriom Formulation for Transportation Networks

Dung-Ying Lin, National Cheng Kung University, Taiwan-ROC, dylin@mail.ncku.edu.tw, Pak Weng Leong

The traditional trip-based approach to transportation modeling has been employed for the past decade. The last step of the trip-based modeling approach is traffic assignment, which has been typically formulated as a user equilibrium (UE) problem. In the conventional perspective, the definition of UE traffic assignment is the condition that no road user can unilaterally change routes to reduce their travel time. The underlying assumption of the UE definition is that road users have full information on the available transportation paths and can potentially use any path if the currently used path is overly congested. However, a more practical scenario is that each road user has a limited path set within which she/he can choose routes from. We introduce a new formulation of the user equilibrium to capture the feature and derive optimality conditions based on this formulation. To efficiently solve this problem, we devise path-based and link-based solution algorithms. Numerical results demonstrate that new equilibrium results can differ significantly from UE results depending on the number of paths available to road users.

■ WA48

48- North 231 A- CC

Facility Logistics IV

Sponsor: Transportation Science & Logistics/ Facility Logistics

Sponsored Session

Chair: Pratik Parikh, Assistant Professor, Wright State University, 3640 Col Glenn Hwy, Dayton, OH, 45435, United States of America, pratik.parikh@wright.edu

1 - Developing Distribution Plans Accounting for Warehousing Decisions

Pratik Parikh, Assistant Professor, Wright State University, 3640 Col Glenn Hwy, Dayton, OH, 45435, United States of America, pratik.parikh@wright.edu, Nan Kong, Bhanuteja Sainathuni, Xinhui Zhang

We propose an approach to integrate warehousing decisions with inventory and transportation for supply chains. This problem is motivated by our observations at several supply chains that have experienced substantial operational inefficiencies due to a lack of such integration. Accounting for warehousing decisions can lead to both reductions in daily workload variance and total distribution cost. We also discuss a heuristic that can solve problem instances with over 100 stores and 1000 products.

2 - Cluster-based Optimal Location Planning of Urban Transit Hubs

Yue Liu, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, WI, 53201, United States of America, liu28@uwm.edu, Jie Yu, Zhenke Luo

This paper presents an optimization model planning urban transit hub locations. The model features a bi-level structure with the upper-level determining the hub locations to minimize the total transportation and facility cost. The lower-level models the behavior of buses and passengers in choosing optimal hubs and transportation routes. GA is employed to yield meta-optimal solutions.

3 - The Destination-Loader-Door Assignment Problem for Cross-docking Facilities

Ahmad Jarrah, Associate Professor, The George Washington University, Department of Decision Sciences, Washington, DC, 50052, United States of America, jarrah@gwu.edu, Xiangtong Qi, Jonathan Bard

We present a model and solution procedure for a problem that arises in configuring transshipment hubs. The first objective is to minimize the number of changes of destination-to-door assignments from one sort to the next. The second and third objectives are to minimize the number of loaders and to evenly distribute the volume of packages assigned to each loader. We strengthen the problem's MIP formulation via effective cuts, and use preemptive optimization to obtain near-optimal solutions.

4 - Integrating Predictive Dynamic Travel Times in City Logistics Routing

Lan Jiang, Northwestern University, Evanston, IL, United States of America, lan@u.northwestern.edu, Hani S. Mahmassani

Time-varying trip times produced by a traffic estimation and prediction system are used in dynamic routing decisions for pick-up/distribution fleets. The impact of these vehicles on trip times is in turn incorporated in the predictive framework. Notions of mutual consistency in a rolling horizon framework are discussed.

■ WA49

49- North 231 B- CC

Congestion Pricing

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Marco Nie, Northwestern University, Evanston, IL, 60208, United States of America, y-nie@northwestern.edu

1 - Solving the Bottleneck Model with General Distributions of Value of Time and Cost of Schedule Delay

Yang Liu, Northwestern University, Evanston, IL, United States of America, yangliu@u.northwestern.edu

This paper studies deterministic departure-time equilibriums in the bottleneck model with users who differ in their valuation of travel time and punctual arrival. An algorithm is proposed to solve the problem with general distributions of value of time and cost of schedule delay. The uniqueness and the existence conditions of user equilibriums are explored. Another algorithm s introduced to solve the system optima in which queuing delay is eliminated by a system optimum (SO) toll scheme.

2 - A Congestion Pricing Problem with Embedded Mobile Source Emission Models

Tao Yao, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, taoyao@psu.edu, Ke Han, Hongcheng Liu, Terry Friesz

An emission model will be integrated into the Lighthill-Whitham-Richards traffic flow model. Aim of this work is to understand the impacts of network flow pattern and driving behavior on transportation emissions, as well as to exploit the engineering aspect of emission control.

3 - Impact Analysis of Time-dependent Road Network Tolling on Travel Choices

Jing Dong, Iowa State University, 394 Town Engineering, Ames, IA, 50011, United States of America, jingdong@iastate.edu

This paper studies the effect of usage-based vehicle charges on the behavior patterns of road users based on the revealed preference survey data. Travelers' response to time-dependent network-wide toll charges includes reduction in vehicle miles traveled, combination of multiple trips and departure time shift.

4 - Analysis of Tradable Mobility Credits under Uncertainty

Nima Shirmohammadi, PhD Student, University of Florida, 518C, weil hall, Gainesville, FL, 32611-6580, United States of America, nimashir@ufl.edu, Yafeng Yin

Congestion pricing and tradable credits schemes achieve the same level of efficiency in an idealized environment of perfect certainty. However, these two instruments behave differently under uncertainty. This study analyzes and compares the performance of tradable credits and congestion pricing in controlling total vehicle miles travelled in a general network with uncertain demand and degradable capacity, and provides insights on how to design tradable credits schemes against uncertainty.

5 - Sequential Implementation of Tolls to Guide Flow Evolution under Bounded Rationality

Xiaolei Guo, Assistant Professor, University of Windsor, Odette School of Business, Univ. of Windsor 401 Sunset Ave., Windsor, ON, N9B 3P4, Canada, guoxl@uwindsor.ca, Kevin Li

Because boundedly rational user equilibrium (BRUE) always has a set of solutions instead of a unique one, from a static network equilibrium viewpoint, under BRUE there is no guarantee of attainability of any specific target flow by implementing tolls. In this study, from a disequilibrium flow evolution perspective, we design toll implementation sequences to guide the network flow to evolve towards any target flow under boundedly rational flow adjustment processes.

■ WA51

51- North 232 A- CC

Methods Supporting Military Logistics and Testing

Sponsor: Military Applications

Sponsored Session

Chair: Thomas Willemain, Vice President, Smart Software, Inc., 4 Hill Road, Belmont, MA, 02478, United States of America, tomw@smartcorp.com

1 - Using Sensor Data to Improve the Management of Spare Parts

Jennifer Ryan, Associate Professor, RPI, 110 8th Street, CII, Troy, NY, 12180, United States of America, ryanj6@rpi.edu, Xi Kan, Rong Li, Zhi Zeng

This talk will discuss methods for incorporating real-time sensor information obtained through condition monitoring into inventory management and replacement decisions for service parts. We consider the problem faced by a manufacturer who manages inventory for a machine part that is used on a large number of geographically-dispersed machines and which is subject to deterioration. The manufacturer's goal is to use the real-time sensor information to improve his service parts inventory management.

2 - Operations Research Techniques for Planning in Test and Evaluation

Darryl Ahner, Air Force Institute of Technology, 2905 Hobson Way, WPAFB, OH, 45433, United States of America, darryl.ahner@afit.edu

The National Research Council Panel on Statistical Methods for T&E of Defense Systems has stated many times since 1998 that current practices in the Department of Defense do not take full advantage of the benefits available from the use of state-of-the-art statistical methodology, including experimental design techniques. This presentation will discuss the use of operations research techniques in effectively and afficinetly planning and analyzing integrated testing of new systems.

3 - Accurate Forecasts of Spare Part Demand

Thomas Willemain, Vice President, Smart Software, Inc., 4 Hill Road, Belmont, MA, 02478, United States of America, tomw@smartcorp.com

The US military manages vast inventories of spare parts. Many parts have demand that is "intermittent" and therefore difficult to forecast. We describe a patented method that combines Markov modeling with bootstrapping to make the accurate estimates of high percentiles of lead time demand that are required for efficient inventory management.

■ WA52

52- North 232 B- CC

Renewable Electricity Markets and Policies

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Reinhard Madlener, Professor of Energy Economics and Management, RWTH Aachen University, Mathieustrasse, Aachen, 52074, Germany, RMadlener@eonerc.rwth-aachen.de

1 - On the Value of Better Models for the Electricity Sector

Alberto Lamadrid, Graduate Student, Cornell University, 419 Warren Hall, Ithaca, NY, 14850, United States of America, ajl259@cornell.edu, Tim Mount, Ray Zimmerman, Robert Thomas, Carlos Murillo

This paper measures the value of the stochastic solution for a system with penetration of renewable energy sources, by comparing it to a deterministic formulation with fixed locational reserves. Our model of the electricity network has a system planner seeking to minimize the cost of providing both energy and ancillary services using a security constrained Optimal Power Flow and explicitly reproducing the uncertainty in the system by using a Markovian transition probability matrix.

2 - Renewable Electricity Policies Comparison in the Long Run using Decomposition Methods

Steffen Rebennack, Assistant Professor of Operations Research, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, srebenna@mines.edu, Timo Lohmann

Many policies directly promote investment in renewable electricity generators. Other policies create incentives for investment in proportion to social value. We present a long-run planning model to compare the effect of these policies on investment decisions. The challenging part of this integrated model is to solve for equilibrium quantity and price for every hour of the horizon, which is typically more than 20 years. We propose a decomposition approach to solve this problem to optimality.

3 - Demand Management in Smart Grid

Mona Asudegi, University of Maryland, 9348 Cherryhill Road, College Park, MD, 20740, United States of America, asudegi@umd.edu, Ali Haghani

Climate change concerns, high oil prices, and energy security are major concerns in recent decades. Using renewable energies in addition to demand side management of the consumers are inevitable contributors which can help overcoming these concerns. This study is proposing a Demand Response model to manage different resources of generation and consumption including plug in electrical vehicles in the Smart Grid which is the future of energy systems.

4 - Market Premium for Self-marketing of Renewable Electricity in Germany: A Stochastic Analysis

Reinhard Madlener, Professor of Energy Economics and Management, RWTH Aachen University, Mathieustrasse, Aachen, 52074, Germany, RMadlener@eonerc.rwth-aachen.de, Joscha Schabram

The revised German Renewable Energies Act (EEG) 2012 introduced market premiums as a new instrument to provide an incentive for the self-marketing of renewable electricity. In our study, we investigate the optimal amount of capacity plant operators should market themselves for the provision of reserve energy. To this end, we apply mean-variance portfolio theory with the Conditional Value-at-Risk (CVaR) as the risk measure of choice.

■ WA53

53- North 232 C- CC

Applications of Parallelization and High Performance Computing in Electric Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Anthony Papavasiliou, University of California at Berkeley, 4141 Etcheverry Hall, IEOR Department, Berkeley, CA, 94720-1777, United States of America, anthony.papavasiliou@gmail.com

1 - Scalable Parallel Solution of Stochastic Unit Commitment Via Scenario-based Decomposition

Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87113, United States of America, jwatson@sandia.gov, David L. Woodruff, Roger Wets

Stochastic unit commitment remains a serious challenge at utility scales, in terms of obtaining high-quality solutions in tractable run-times given large scenario trees. To address this challenge, leveraging moderate-scale cluster computing, we describe an implementation of Progressive Hedging (PH) that we are developing under the Department of Energy's ARPA-E GENI program. We describe algorithmic challenges and our proposed solutions to large-scale parallel deployment of PH.

2 - Multi-stage Stochastic Optimization and Cloud Computing Applied to Energy Systems

Luiz Carlos Costa Jr, PSR, Praia de Botafogo 228/1701-A, Rio de Janeiro, RJ, 22250-145, Brazil, luizcarlos@psr-inc.com, Nora Campodonico, Luiz Mauricio Thomè, Mario Veiga Pereira

We describe the use of a distributed processing version of the stochastic dual dynamic programming algorithm (SDDP) to two large scale real-life applications: (i) transmission interconnections planning for 16 Latin American countries; and (ii) a spot price forecasting system for the Scandinavian electricity market (Nordpool). Both applications require stochastic scheduling of a very large number of hydro plants and thus the solution of stochastic DP problems with several hundred state variables.

3 - Applying High Performance Computing to Multi Area Stochastic Unit Commitment for Wind Penetration

Anthony Papavasiliou, University of California at Berkeley, 4141 Etcheverry Hall, IEOR Department, Berkeley, CA, 94720-1777, United States of America, anthony.papavasiliou@gmail.com, Shmuel Oren

Our work is focused on the stochastic unit commitment problem applied to the case of large-scale renewable energy integration. We present a parallel implementation of a Lagrangian relaxation algorithm for solving the problem over a high performance computing cluster of 1000 servers. We investigate the sensitivity of our results on the number of scenarios that are used, compare the resulting policies with N-1 reliable unit commitment and present computational results on speedup and efficiency.

4 - High Performance Computation and Approximate Dynamic Programming for the Energy Storage Problem

Somayeh Moazeni, Research Associate, Princeton University, Sherrerd Hall, Charlton Street, Princeton, NJ, 08536, United States of America, somayeh@princeton.edu, Warren Powell, Hugo Simao

The energy storage problem deals with finding the flow of electricity among a grid operator with stochastic prices, a wind generator with stochastic supply, and a storage device, to maximize the total revenue and meet a stochastic demand. Direct policy search and a model reference adaptive search are then adopted to solve the resulting optimization problem. Parallel implementations on a multi-cluster supercomputer are explored and numerical experiments to demonstrate scalability are provided.

■ WA54

54- Regency Ballroom A- Hyatt

Disease Management

Contributed Session

Chair: Siddhartha Sampath, Arizona State University, 849 W Elna Rae, Tempe, AZ, United States of America, Siddhartha.Sampath@asu.edu

1 - Optimal Screening for Preclinical Diseases

Ang Li, Texas A&M University, Dept. of Industrial & Systems Engineering, College Station, TX, 77840, United States of America, ise.angli@tamu.edu

In this study, we consider the optimal policy to screen a population for a pre-clinical cancer. We model the population's disease-free time as a log-concave density, and the pre-clinical period as any continuous density. Our objective is to place N screening times to maximize the probability of identifying the disease during its symptom-free period. We show that a unique optimal sequence of screening times exist, and we find this solution by a simple binary search algorithm.

2 - Population Games in Liver Transplant Society

Zhe Li, PhD Candidate, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, lizhe@iems.northwestern.edu, James Schummer, Gordon Hazen, Anton Skaro

We view the entire liver transplant society as a huge system. The policy maker of the system wants to deploy policies in anticipation of maximizing societal benefits, while individual patients and transplant centers have their own goals. Our goal here is to find out the stationary equilibrium in the system in accordance with different allocation policies, which in hope helps the process of better policy making.

3 - Donor-Dependent Scoring Scheme: Making the Right Tradeoff

Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 10, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

We undertake a modeling-based analysis to compare two special types of scoring policy, the donor-dependent scoring scheme (DDSS) and the donor-independent scoring scheme (DISS), and policies based on partitioning the waitlist. The result shows that a DDSS makes the best tradeoff between reducing the number of kidney rejections and allowing patients more freedom in choosing their kidneys.

4 - A Markov Decision Process Model for the Timing of Discharge for Congestive Heart Failure Patients

Siddhartha Sampath, Arizona State University, 849 W Elna Rae, Tempe, AZ, United States of America, Siddhartha.Sampath@asu.edu, Esma Gel

We attempt to model the post-operative stay of congestive heart failure patients at the Mayo Clinic as an optimal stopping problem in order to determine the optimal time of discharge. Our goal is to determine the optimal time a patient should be discharged from hospital care given their vital statistics and background information. We are able to utilize dynamic programming incorporating all the different costs involved in the system to determine this.

5 - Artificial Neural Network Modeling of Nanoparticle-cell Interactions

Ihsan Sabuncuoglu, Bilkent University, Bilkent University, Ankara, Turkey, sabun@bilkent.edu.tr, Savas Dayanik, Gürer Budak, Neslihan Cenk

In this study, a prediction model for the cellular uptake efficiency of nanoparticles (NPs), is investigated via artificial neural network (ANN) method. Specifically, a proper ANN model with a multilayered feed-forward back-propagation algorithm is developed by considering NP type, size, surface charge, concentration and time for prediction of cellular uptake efficiency. The NP types for in-vitro NP-healthy cell interaction analysis are polymethyl methacrylate (PMMA), silica and polylactic acid (PLA), all of whose shapes are spheres. The proposed ANN model has been developed via MATLAB Programming Language by optimizing a number of hidden layers (HLs), node numbers and training functions. The datasets for training and testing the network are obtained from in-vitro NP-cell interaction experiments conducted by Nanomedicine and Advanced Technology Research Center. The dispersion characteristics and cell interactions with different nanoparticles in organisms are explored using an optimal ANN prediction model.

■ WA55

55- Regency Ballroom B - Hyatt

Aviation Technology and Management

Contributed Session

Chair: Mo Yang, Student, Tsinghua University, Department of Automation, Beijing, China, yangmo1988@gmail.com

1 - Application and Evaluation of Bibliometrics Methods for the Materials Science and Engineering

Shingo Ii, The University of Tokyo, 5-1-5 Kashiwanoha, Kashiwa, 277-8561, Japan, ii@smart.k.u-tokyo.ac.jp, Hiroko Nakamura, Toshio Ogasawara

Use of CFRP (Carbon Fiber Reinforced Plastics) in the aerospace industry is trend because of its high strength-to-weight ratio but has not a few problems for further application. To bring new solutions in CFRP, we took a bibliometrics method, which is uncommon in material researches, to gather broad knowledge effectively in and outside of CFRP researches. And finally we discussed the feasibility of a bibliometrics method in the material researches.

2 - A Negotiation Game Analysis on Airport and Airline Risk Sharing Contract

Katsuya Hihara, The University of Tokyo, 7-1-3 Hongo Bunkyo-ku, Tokyo, Japan, hihara@pp.u-tokyo.ac.jp, Naoki Makimoto

We analyze a linear risk sharing contract between airport and airline with generalized Nash bargaining solution and Cournot game frameworks. The slope and the point of common effort target of the contract are to be agreed respectively to maximize total welfare and to, based on bargaining power, share the contract's welfare gain equitably.

3 - Evaluation of the Airline Service Quality: Are Low-cost Airlines also Cost-effective?

Praowpan Tansitpong, VH303 School of Business, State University of New York at New Paltz, 1 Hawk Drive New, New Paltz, NY, 12561, United States of America, tansitpp@newpaltz.edu, Muge Yayla-Kullu

In this paper, we study the airline industry. We look at how well operating costs translate into service quality. Past literature has focused on either the load factors or the mistakes of the industry (e.g., on-time arrivals, lost baggage) to measure the airlines' performance. Ours is the first study to consider customer-perceived quality. We find that not all low cost airlines are indeed cost effective.

4 - Multiple Runway Scheduling Problem with Reduced Taxi Time

Mo Yang, Student, Tsinghua University, Department of Automation, Beijing, China, yangmo1988@gmail.com, Peng Cheng

Runway scheduling always minimizes the delays of arrivals and departures, but under collaborative decision making mechanism, the controllers should also consider about the pilot and passengers' comfort level without enduring long taxi time. Investigating both the runway configuration management and runway scheduling problem, we propose a mixed integer program model which can reduce flight delays while at the same time reduce the taxi time by assigning aircrafts to their preferred runways.

■ WA56

56- Curtis A- Hyatt

Technology Management in the Service Sector

Sponsor: Technology Management

Sponsored Session

Chair: Tugrul Daim, Associate Professor and PhD Program Director of Engineering and Technology Management, Portland State University, ETM Dept, Maseeh College of Engineerg, P.O. Box 751, Portland, OR, 97207-0751, United States of America, tugrul@etm.pdx.edu

1 - Exploring University Technology Transfer Incorporating Time-lags and Institutional Characteristics

Jisun Kim, Portland State University, Portland, OR, United States of America, kimjisun73@gmail.com, Tugrul Daim

This paper aims to develop institutional strategy to improve the licensing practice of academic research institutions based on further understanding of licensing performance and related institutional characteristics. The results which are grounded on the comprehensive observations over multiple time durations provide an insight into the licensing practices of US research institutions.

2 - Health Information Technology Adoption

Nima Behkami, Portland State University, Portland, OR, United States of America, behkamin@hotmail.com, Tugrul Daim

Using an interdisciplinary study of healthcare and technology, the objective of this research is to measure the prevalence of health information technology capabilities and their impact on delivery of care. We surveyed health care providers for prevalence their capabilities used to implement a Patient-Centered Medical Home.

3 - A Technology Screening Tool for Energy Efficiency Program Planning in Electric Utilities

Ibrahim Iskin, PhD Student, Portland State University, Department of Engineering &Technology Mngmt, 1900 SW 4th Ave., Suite LL-50-02, Portland, OR, 97201, United States of America, ibrahimiskin@gmail.com, Tugrul Daim

Number of potential energy efficiency program alternatives is huge due to existence of numerous energy efficient technologies and end use areas. Most of the time energy savings data for emerging energy efficiency technologies is not in place, and data collection becomes a serious issue. Proposed approach is intended to utilize expert judgment and provide a quick way of surveying large number of program alternatives, saving energy planning practices resource and time.

■ WA57

57- Curtis B- Hyatt

Data Driven Stochastic Service Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Robert Hampshire, Assistant Professor of Operations Research, Carnegie Mellon University, Heinz College, 4800 Forbes Avenue, 2102B Hamburg Hall, Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

1 - Do Drivers See Time Averages?

Robert Hampshire, Assistant Professor of Operations Research, Carnegie Mellon University, Heinz College, 4800 Forbes Avenue, 2102B Hamburg Hall, Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

Many cities are deploying smart parking information systems. The goal of smart parking initiatives is to reduce the number of cruising drivers. As a rule of thumb, smart parking interventions typically set average occupancy targets for each block throughout the day. We seek to explore how drivers experience these average occupancy targets. Using data, from 1 year of observations from 17,000 sensors, we analyze how average occupancy is experienced by drivers in San Francisco.

2 - Asymptotic Analysis for a System with Reneging

Katsunobu Sasanuma, PhD Student, Carnegie Mellon University, Heinz College, Pittsburgh, PA, 15213, United States of America, katz@cmu.edu, Robert Hampshire, Alan Scheller-Wolf

It is known that a simple square staffing rule can be used when obtaining the necessary number of staffs in a service center with no reneging. However, under reneging condition, such a simple square staffing rule does not hold. In this talk, we propose a new method to analyze asymptotic property of a system with reneging. We also show a revised staffing rule for a system with reneging.

3 - Bayesian Inference for Queueing Networks

Charles Sutton, University of Edinburgh, 10 Crichton St., Edinburgh, EH8 9AB, United Kingdom, Csutton@inf.ed.ac.uk, Michael I Jordan

The performance of modern Internet services can be modeled by networks of queues. But we cannot afford detailed logging of every job in the system. Instead we assume that arrival and departure times have been recorded for a random subset of jobs, and we wish to infer the arrival and departure times of the remaining jobs. To accomplish this we introduce a Bayesian perspective on queueing networks, focusing on the distribution of the unobserved times conditioned on the recorded ones.

4 - Estimating Interacting Processes with the Principle of Maximum Causal Entropy

Brian Ziebart, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, bziebart@cs.cmu.edu, Drew Bagnell, Anind Dey

The principle of maximum entropy prescribes joint and conditional probability distributions with optimal worst-case predictive guarantees. This work leverages directed information theory to extend the maximum entropy approach to settings where predicted variable sequences interact with known processes. We demonstrate the approach by applying it to predict people's behavior in decision settings, where the known process corresponds to a known state transition dynamics distribution.

■ WA58

58- Phoenix East- Hyatt

Limit Order Book Dynamics and High-frequency Market Microstructure

Sponsor: Applied Probability

Sponsored Session

Chair: Costis Maglaras, Columbia University, 3022 Broadway, New York, NY, United States of America, c.maglaras@gsb.columbia.edu

1 - Optimal Order Routing in a Fragmented Market

Hua Zheng, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, hzheng14@gsb.columbia.edu, Ciamac Moallemi, Costis Maglaras

In modern equity markets traders have the choice of many exchanges, each operating as an electronic limit order book. We find that the equilibrium of this decentralized market exhibits a state space collapse property as a result of smart order routing. Analysis of a TAQ dataset provides strong empirical support for SSC. PCA show significant dimension reduction of delay trajectories, while regressions verify simple linear relations. Our estimates explain most of the variability in trading delays.

2 - A Multiclass Queueing Model of Limit Orders

Arseniy Kukanov, PhD Candidate, Columbia University, 544 West 113 Street, 2R, New York, NY, 10025, United States of America, arseniy.kukanov@gmail.com, Costis Maglaras

In modern electronic markets, heterogeneous agents submit limit orders to a centralized order book, which can be represented as a queueing system. The heterogeneity of orders and their interaction within a single order queue results in exceptionally long execution delays (waiting times) for large queues and anomalous bursts of activity for small queues. We develop a two-class model of an order queue at the best bid (or offer) of an exchange and show that it adequately captures such behavior.

3 - Double-sided Batch-arrival Queues with Abandonment: Modeling and Performance of Crossing Networks

Adam Diamant, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, Canada, Adam.Diamant09@rotman.utoronto.ca, Philipp Afeche, Joseph Milner

The growing significance of crossing networks in financial markets calls for a better understanding of their operational performance. We model these as double-sided batch arrival queues with abandonment. We analyze how key performance measures such as system times and fill rates depend on order flow characteristics. We (1) derive closed-form expressions for these measures; (2) gain insights on system-level and customer-level performance; (3) validate our analytical results via simulation.

4 - Information and the Value of Execution Guarantees
Krishnamurthy Iyer, Stanford University, Stanford, CA, United States of America, kriyer@stanford.edu, Ramesh Johari, Ciamac Moallemi

We assess the role of information in the choice between certain trade at a price premium in an intermediated dealer market and contingent trade in a dark pool. Our setting consists of traders with heterogeneous private information as to an asset's value, who endogenously decide between these two venues. We analyze how this choice depends on the information available to an individual trader, as well as the overall distribution of information across all traders and the premium for certain trade.

■ WA60

60- Remington- Hyatt

Delay Patterns in Aviation Networks

Sponsor: Aviation Applications

Sponsored Session

Chair: Lavanya Marla, Carnegie Mellon University, Pittsburgh, PA, United States of America, lavanyamarla@cmu.edu

1 - Characterization and Prediction of Air Traffic Delays
Hamsa Balakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Ave., 33-328, Cambridge, MA, 02139, United States of America, hamsa@mit.edu, Juan Jose Rebollo

We present a new model for predicting delays in the National Airspace System (NAS), considering both temporal and spatial delay states as explanatory variables. We propose new network delay variables that depict the global delay state of the entire NAS at the time of prediction. The predictive performances of the proposed classification and regression models are evaluated using operational data, and the effects of changes in the classification threshold and prediction horizon are studied.

2 - Maintenance Recovery in Passenger Aviation
Amy Cohn, University of Michigan, Ann Arbor, MI, United States of America, amycohn@umich.edu, Marcial Lapp, Sergey Shebalov

Preventative maintenance is an important aspect of passenger aviation and must be planned in advance. When flight operations are disrupted, this can disrupt the maintenance plan as well. We present models and algorithms for addressing this problem.

3 - Delay Distributions in Aircraft Routes
Lavanya Marla, Carnegie Mellon University, Pittsburgh, PA, United States of America, lavanyamarla@cmu.edu

We discuss our empirical findings about delay distributions occurring on aircraft paths. We further discuss the reasons for such delay patterns and models for mitigating these delays.

4 - Using Real-time Delay Information to Prioritize Early Standby and Reaccomodation of Passengers
Brittany Luken, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, United States of America, brittany.l.luken@gmail.com, Laurie Garrow

On average a disrupted airline passenger (from misconnect or cancellation) is delayed 8 hours. Priority for early standby or reaccomodation of passengers is often determined by some combination of ticket fare, itinerary or frequent flyer status without regard to the likelihood of passengers getting disrupted later in their itinerary. This research illustrates how real-time delay models can be used to prioritize early standby or reaccomodation of passengers to minimize total passenger delay.

■ WA61

61- Russell- Hyatt

Homeland Security Analytics - II

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: Barry Ezell, Chief Scientist, Virginia Modeling, Analysis and Simulation Center, 1030 University Blvd, Suffolk, VA, 23435, United States of America, bezell@odu.edu

1 - Tornado and Flood Risks in the DHS Strategic National Risk Assessment (SNRA)
Joel Piper, DHS SPAR, 245 Murray Lane SW, Bldg. 410, Mail Stop: 0445, Washington, DC, 20016, United States of America, Joel.Piper@hq.dhs.gov

The SNRA characterizes risks to the Nation (including terrorism and national disasters) to help guide national preparedness. In many cases, the regional risks (a flooded watershed or multiple tornadoes spawned from a storm system) are more relevant to the Federal response than individual isolated events. For these situations, DHS has developed a clustering algorithm that aggregates events based on distance and time separation to better inform a broad response to natural disasters.

2 - Integrating Multiple Data Sources for Biosurveillance
Steve Bennett, Director, DHS National Biosurveillance Integration Center, United States of America, Steve.Bennett@dhs.gov

The 2010 Department of Homeland Security (DHS) Quadrennial Homeland Security Review states "ultimately Homeland Security is about effectively managing risks to the Nation's security." With risk defined as the likelihood and consequences of potential unwanted events, managing risks from covert or naturally-occurring, accidental, or deliberate biological events such as bioterrorism or emerging infectious disease or bioterrorism is difficult to accomplish through activities that attempt to reduce these events' likelihood of occurrence. Instead, activities that mitigate these risks largely focus on reducing, managing, or limiting the consequences of biological events once they begin to occur. To do this effectively requires the earliest possible warning that an event is occurring, as well as continuing shared situational awareness throughout the event, to enable effective decision making regarding what management actions should be taken. In this presentation, we will describe the mission and activities of the National Biosurveillance Integration Center within DHS, charged with enabling early warning and providing shared situational awareness for biological events of national concern, focusing on a variety of new pilot projects that apply advanced analytics to integrate multiple streams of data. Specifically, real-time biosurveillance-relevant data such EMS, Emergency Department, 911, Poison Control information, and social media are all currently being developed for biosurveillance applications through advanced analytics and visualization.

3 - Target-oriented Utility for Interdiction of Transportation Networks
Fuat Kosanoglu, University of Wisconsin, UW-Madison 3237 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, kosanoglu@wisc.edu, Vicki Bier

In this talk, we study an optimal resource-allocation model for more cost-effective protection of transportation networks. We apply target-oriented utility theory and use mixed integer programming to determine the optimal level of investment needed to interdict an attacker on a transportation network. We also analyze the effects of attacker behavior on the defender's optimal investment decision.

4 - DHS Risk Characterization Methodology for Global Supply Chain Security
Debra Elkins, DHS Policy, Office of Strategy, Planning, Analysis and Risk (SPAR), U.S. Department of Homeland Security, Washington, DC, United States of America, debra.elkins@hq.dhs.gov

The U.S. Department of Homeland Security (DHS) is leading a U.S. Government "Risk Characterization" to support the White House National Strategy on Global Supply Chain Security. DHS will talk about developing a Risk Characterization Methodology, and how the OR/MS community is helping to inform and shape this global problem space.

■ WA62

62- Borein A- Hyatt

Managing Product Variety

Contributed Session

Chair: Tulin Inkaya, Postdoctoral Associate, Arizona State University, School of Mathematical and Statistical, Sciences, Tempe, United States of America, tinkaya@asu.edu

1 - Product Portfolio Management with Product Life Cycle Considerations

Ariel Zeballos, EPFL, Station 5, EPFL CDM TOM, ODY 4.16, Lausanne, 1015, Switzerland, ariel.zeballos@epfl.ch, Ralf Seifert, Jean-Sèbastien Tancrez

In this work, we build a model for portfolio management of product lines, where products probabilistically transition through their life cycle stages. The evolution through these stages are impacted by marketing and launching decisions. Moreover, the company decides the joint level of working capital to finance the portfolio's expenditures. Using a Markov decision process, we find the optimal decisions which balance the operations and finance depending on the portfolio's composition.

2 - Variety Competition for Vertically Differentiated Products

Tulin Inkaya, Postdoctoral Associate, Arizona State University, School of Mathematical and Statistical, Sciences, Tempe, United States of America, tinkaya@asu.edu, Karl Kempf, Hongmin Li, Dieter Armbruster

We consider a supply chain with a manufacturer and multiple assembly companies. The manufacturer offers products vertically differentiated by quality. Assembly companies determine their product variety in a competitive environment considering the end-customers' behavior. We analyze the impact of the manufacturer on the product variety game among the assembly companies.

3 - Dynamic Capacity Planning for Innovative Products with Short Life Cycles

Saman Alaniazar, Wayne State University, Industrial and Systems Engineering, Detroit, MI, 48202, United States of America, dv2663@wayne.edu, Alper Murat, Ratna Babu Chinnam

We study dynamic capacity planning for Innovative Short Life-cycle Products. Given stochastic and non-stationary demand process with unknown parameters, we develop a modeling and solution approach that can be employed for both strategic (one-time) and dynamic expansions. We provide necessary and sufficient conditions for optimal policy. We then present an exact solution method which is more efficient than classical recursive methods. We present managerial insights using detailed experiments.

■ WA63

63- Borein B- Hyatt

Behavioral Issues in Procuring Services and Goods

Sponsor: Behavioral Operations

Sponsored Session

Chair: Karthik Ramachandran, Georgia Institute of Technology, Atlanta, GA, United States of America, karthik.ramachandran@scheller.gatech.edu

1 - Strategic Procrastination to Exploit the Time-Quality Trade-off

Sreekumar Bhaskaran, Southern Methodist University, Cox School of Business, P.O. Box 750333, Dallas, TX, 75275, United States of America, sbhaskar@mail.cox.smu.edu

Obtaining higher quality requires greater effort and time. Hence, observing the completion time of a task allows a principal to rationally make inferences about the outcome quality. This brings up the interesting possibility that rational agents might exploit the principals rational inference by strategically delaying task completion to signal higher quality. We examine this effect through an experimental setup and explore its implications through an analytical model.

2 - Strategic Buyers and Posted Prices: An Experimental Study

Seungbeom Kim, PhD Candidate, University of Southern California, Marshall School of Business IOM Dept, Bridge Hall 401, Los Angeles, CA, 90089-0809, United States of America, seungbek@usc.edu, Sriram Dasu

We conduct laboratory experiments to investigate buyers' decision processes when discounted products may be stocked out. The results yield little evidence in support of the decision processes assumed by the theoretical pricing models. Instead, buyer behavior can be better explained by the quantal response framework. Moreover, buyer decisions demonstrate several systemic biases such as anchoring and reference dependence. We discuss the implications that our findings hold for pricing strategies.

3 - Ordering Behavior under Supply Risk: An Experimental Investigation

Yusen Xia, Associate Professor, Georgia State University, J. Mack Robinson College of Business, Atlanta, GA, 30303, United States of America, ysxia@gsu.edu, Haresh Gurnani, Karthik Ramachandran, Saibal Ray

In this presentation, we show results from a study where human subjects were asked to place orders from two suppliers who differ in their costs and reliabilities to satisfy a fixed amount of end customer demand. Under such a scenario, it is optimal to sole-source exclusively. However, subjects in our experiment show a systematic tendency to diversify their orders between the sources even if such an action increases their risk and reduces their expected pro t.

■ WA64

64- Cowboy Artist- Hyatt

Applications of Data Mining I

Contributed Session

Chair: Yoonjin Yoon, Assistant Professor, Korea Advanced Institute of Science and Technology, Dept of CEE, 291 Daehak-ro, Yuseong gu, Daejeon, Korea, Republic of, yoonjin@kaist.ac.kr

1 - Forecasting Bookings Based on CRM Pipeline Data

Sricharan Poundarikapuram, SAP Americas, 4343 N Scottsdale Rd, Suite 260, Scottsdale, AZ, 85251, United States of America, sricharan.poundarikapuram@sap.com, Bin Qin, Gustavo Ayres de Castro

In this article, we discuss alternative approaches to forecast B2B bookings based on CRM pipeline data including the application of survival analysis methods used in medical field, and compare against generalized boosted regression models from data mining literature. Both the approaches have been successfully implemented on SAP's CRM data using the SAP HANA in-memory database, and its R-integration for modeling on large-scale data.

2 - Think Global Act Local

Karen Zhang, Director Customer Intelligence, HP, 3000 Hanover Street, Blg 20A, MS 1052, Palo Alto, CA, 94085, United States of America, karen.zhang@hp.com, Ritwik Sinha, Manav Shroff

Decades of rapid growth in China has lead to organizational scales ready to reap the benefits of data driven decisions. At HP, we built a team that brings global analytical knowhow to solve business problems for China HP. This involves 1) creating a foundational knowledgebase, 2) establishing a local team and 3) building cutting edge analytical solutions - like text analytics of unstructured Chinese data. We display the challenges faced and steps taken to succeed through case studies.

3 - Using Web Data for Acquiring Profitable Customers

Jeroen D'Haen, UGent, Tweekerkenstraat 2, Ghent, 9000, Belgium, jeroen.dhaen@ugent.be, Dirk Thorleuchter, Dirk Van den Poel

The proposed research goal is to assist sales reps in the sales process by predicting the acquisition of profitable potential customers. It investigates the predictive performance of two sources of data: web data and commercially available data. It also investigates the performance of different data mining techniques. Results show that bagged decision trees have the highest accuracy. Web data is better in predicting profitability than commercial data, but combining both is even better.

4 - Online Behavior Analysis through a Social Media Lens

Mohammad Ali Abbasi, PhD Student, Arizona State University, 699 S. Mill Ave. #553, Tempe, AZ, 85281, United States of America, ali2@asu.edu, Huan Liu

Using a large amount of data collected from Facebook and Twitter, we report our preliminary research to investigate the users' online behavior in finding the correlation between their online and real-world behaviors. The goals of this research is: (1) determining the relative effectiveness of a social media lens in analyzing and predicting real-world collective behavior, and (2) exploring the domains and situations under which social media can be used as a predictor for real-world's behavior.

5 - Understanding the Human Behavior in the Traffic Accident using Data Mining Framework

Yoonjin Yoon, Assistant Professor, Korea Advanced Institute of Science and Technology, Dept. of CEE, 291 Daehak-ro, Yuseong gu, Daejeon, Korea, Republic of, yoonjin@kaist.ac.kr, Ohoon Kwon

We apply the data mining framework to the ten year California Highway Patrol accident data. The objectives of this study are two-folds. First, we rank a variety of contributing factors to traffic accident, not just based on frequency or severity but based on their influences. Second, we study the inter-dependencies among the major factors. Authors believe that the data mining framework provides scientific ground to utilize growing traffic safety data to improve safety policy and directives.

■ WA65

65- Cassidy-Hyatt

Theory of Data Mining I

Contributed Session

Chair: Chao-Lung Yang, Assistant Professor, National Taiwan University of Science and Technology, Industrial Management, 43, Sec 4, Keelung Rd, Taipei, 106, Taiwan - ROC, clyang@mail.ntust.edu.tw

1 - Obtaining an Objective Function for Clustering Problems
Larry E. Stanfel, University of Alabama, Emeritus, Canada, porcupine@hughes.net

Solving clustering problems by optimization techniques requires the selection of objective functions, normally accomplished by intuitive choice. Here, using concepts from Information Theory, one is obtained more rigorously by making definitions, citing propositions, and proceeding to simple theorems. A successful application in molecular biology is presented.

2 - A Generic High Performance Text Matching System
Bin Qin, Principal Consultant, SAP Americas, 4343 N Scottsdale Rd, Suite 260, Scottsdale, AZ, 85251, United States of America, bin.qin@sap.com, Sricharan Poundarikapuram, Dave Lyons, Gustavo Ayres de Castro, Michael Davis

The generic text matching system presented here is a highly parallelized system capable of supporting billions of records with many fields. Different matching algorithms (fuzzy, wildcard, phonetic and exact matches) can be selected. Different logical relations (AND, OR or any combination of them) between searchable fields can be specified. Data statistics is used to reduce number of searches. An actual deployment in federal government shows it improves performance by thousands of times.

3 - Comparing Alternative Probabilistic Clustering Methods for Text Modeling
Soo Ho Lee, The Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, lee.2590@osu.edu, Theodore Allen, Anthony Afful-Dadzie

We identify distributional accuracy as an important consideration relevant to subsystem quality improvement prioritization. By studying five alternative methods including the Latent Dirichlet Allocation topic models, and insights are gained about the strengths of the alternative approaches. A case illustrates the relevance of the results for call center improvement and insights can be used for monitoring unresolved issues and evaluating alternative scripting and routing strategies.

4 - Integration of Principal Component Analysis and Integer Programming for Constrained Clustering
Chao-Lung Yang, Assistant Professor, National Taiwan University of Science and Technology, Industrial Management, 43, Sec 4, Keelung Rd, Taipei, 106, Taiwan-ROC, clyang@mail.ntust.edu.tw

This research aims at developing an integrated method to solve a clustering problem constructed by Complete Must-Link (CML) constraints. First, the principal component scores representing the characteristics of CML are added in the similarity matrix to generate candidate clusters. Then, an integer programming is formulated to select the resulting clusters from candidate clusters. The optimization can guarantee minimum within-cluster distances without losing partition information.

■ WA66

66- Ellis West- Hyatt

Data Driven Methods for Assessment of Radiation Threat

Sponsor: Data Mining

Sponsored Session

Chair: Artur Dubrawski, Director, Auton Lab, Carnegie Mellon University, 5000 Forbes Avenue NSH 3121, Pittsburgh, PA, United States of America, awd@cs.cmu.edu

1 - Experiences with Data Mining in Support of Radiation Portal Monitoring at Border Crossings
Thomas Burr, Los Alamos National Lab, Mail Stop F600, Los Alamos, NM, 87545, United States of America, tburr@lanl.gov, Michael Hamada

Radiation Portal Monitors screen vehicles to protect against illicit special nuclear material (SNM) such as Uranium, which emit neutrons and/or gammas. One complication is naturally occurring radioactive materials (NORM) which leads to nuisance alarms. This paper describes data mining applied to RPMs as related to background suppression; efficient methods to examine multiple candidate alarm options; smoothing spectral data; sensor drift, and pattern recognition to recognize common NORMs.

2 - Nuclear Threat Injection for Data Driven Radiation Threat Assessment
Simon Labov, Lawrence Livermore National Laboratory, P.O. Box 808, L-181, Livermore, CA, 94550, United States of America, slabov@llnl.gov, Karl Nelson

One of the most critical challenges in national security is the detection of a nuclear or radiological weapon in the midst of common radioactive materials. Large quantities of radiation measurement data have been collected and are being used to develop radiation threat assessment capabilities. But for the most part they are missing a critical component: the threats! We describe a broad range of threat models and threat injection techniques and tools that can be used to complete the dataset.

3 - Simultaneous Mapping of Intensity and Locations of Radiological Threats using Mobile Spectrometers
Prateek Tandon, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, prateekt@andrew.cmu.edu, Peter Huggins, Artur Dubrawski

We develop algorithms for Bayesian Aggregation (BA) of evidence collected by mobile gamma-ray spectrometers to produce probabilistic maps of spatiotemporal distributions of radiological threat in urban environments such as cities and buildings. BA enables simultaneous estimation of radiating source locations and their intensities, in the presence of varied background radiation. We provide results of empirical evaluations using real field data with realistic injections of synthetic threats.

4 - Radiation Detector Evaluation using Models of Deployment Environments and Limited Data
Richard Wheeler, Lawrence Livermore National Laboratory, P.O. Box 808, Livermore, CA, 94551, United States of America, Wheeler21@llnl.gov, Karl Nelson

Technology-related programmatic decisions often must rely on model-based analysis and limited empirical data. In many radiation detection applications, for example, it is infeasible to physically test prototype systems against actual threat devices in all relevant operational environments. This talk will describe methodology for using limited data and models to estimate performance of candidate detection systems in a range of potential environments prior to acquisition and deployment.

■ WA67

67- Ellis East- Hyatt

Gaussian Process Modeling for Complex System Control and Forecasting

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Satish Bukkapatnam, Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu

1 - Large-scale Gaussian Process Calculation Without Matrix Factorizations
Jie Chen, Argonne National Laboratory, 9700 S Ave., Bldg 240, Argonne, IL, 60439, United States of America, jiechen@mcs.anl.gov

Gaussian processes are the cornerstone of statistical analysis in many application areas. The calculation is often limited by its need to use the Cholesky factorization on the covariance matrix. We present a matrix-free framework for approximating likelihoods, and demonstrate several large-scale computation results. The favorable scaling of the results shows the usefulness of the framework that eliminates the reliance on matrix factorizations in Gaussian process computations.

2 - Domain Decomposition Approach for Fast Gaussian Process Regression of Large Spatial Data Sets
Chiwoo Park, Assistant Professor, Florida State University, 2525 Pottsdamer St., Tallahassee, FL, 32311, United States of America, cpark5@fsu.edu, Jianhua Huang, Yu Ding

We propose a domain decomposition approach for fast computation of Gaussian process regression with a focus on large spatial data sets. The new approach has comparable or better computation complexity as other competing methods, but it is easier to be parallelized for faster computation. Moreover, the method can be adaptive to non-stationary features because of its local nature and, in particular, its use of different hyperparameters of the covariance function for different local regions.

3 - Inverse Gaussian Processes for Degradation Modeling
Nan Chen, Assistant Professor, National University of Singapore, Department of Industrial and Systems Eng, 1 Engineering Drive 2, Singapore, 129789, Singapore, isecn@nus.edu.sg

This talk investigates the inverse Gaussian (IG) process as an effective model of degradation processes. We have shown that the IG process has a clear physical interpretation for modeling monotone degradations. Its close relationship with the Wiener process promotes several different approaches to account for heterogeneity commonly observed in degradations. The broad applicability of the IG process in degradation modeling is demonstrated using several real world examples.

4 - Dirichlet Process Based Gaussian Mixture Model for Multi-step Forecasting in Complex Systems
Changqing Cheng, Research Assistant, Oklahoma State University, Stillwater, OK, 74078, United States of America, changqing.cheng@okstate.edu, Satish Bukkapatnam

We employed Dirichlet process based Gaussian mixture models to handle the matrix inversion and stationary covariance assumption issues in Gaussian processes, and investigated it for complex system multiple-step forecasting. The application in atomistic Monte Carlo (MC) simulation of carbon nanotube synthesis process indicates that this forecasting approach can save over 80% of the MC simulation computational expense.

5 - Steep-Slope Sampling for Gaussian Process Model
Lulu Kang, Assistant Professor, Department of Applied Mathematics, Illinois Institute of Technology, 10 W 32nd Street, E1-208, Chicago, IL, 60615, United States of America, lkang2@math.iit.edu, C.F. Jeff Wu

In this paper we develop a steep-slope sampling method for Gaussian process (GP) model. GP model has been known for its accurate prediction and extensive computation. To adapt the GP model for large data set, we propose a sampling approach called steep-slope sampling. The sampling probability of each observation is promotional to its correponding pseudo-derivative. Then the GP model is built using the sampled observations. Sequential procedure is developed to increase the prediction accuracy.

6 - Composite Gaussian Process Models for Emulating Expensive Functions
Shan Ba, PhD. Candidate, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, Ga, 30332, United States of America, shan.ba@gatech.edu, Roshan Vengazhiyil

A new type of non-stationary Gaussian process model is developed for approximating computationally expensive functions. The new model is a composite of two Gaussian processes, where the first one captures the smooth global trend and the second one models local details. The new predictor also incorporates a flexible variance model, which makes it more capable of approximating surfaces with varying volatility.

■ WA68

68- Suite 312- Hyatt

Financial Engineering and Applied Probability

Sponsor: Financial Services Section

Sponsored Session

Chair: Ning Cai, Department of Industry Engineering and Logistics Management, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, ningcai@ust.hk

1 - Bank Compensation: Sprint Swimming in Short Bonus Pools
Jussi Keppo, University of Michigan Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, keppo@umich.edu, Esa Jokivuolle

We analyze the link between bankers' risk taking incentives and the duration of their compensation. More specifically, we derive conditions under which compensation duration decreases bankers' risk taking. Empirical results indicate that a proxy for shorter compensation duration (higher bonus per salary) is related with higher leverage of banks.

2 - Closed-form Expansions of Discretely Monitored Asian Options in Diffusion Models
Ning Cai, Department of Industry Engineering and Logistics Management, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong-PRC, ningcai@ust.hk, Chenxu Li, Chao Shi

We propose a closed-form asymptotic expansion approach to pricing discretely monitored Asian options in one-dimensional diffusion models. This expansion method has two appealing features. First, it is possible to explicitly calculate any correction term systematically. Second, the expansion convergence is proved rigorously under some regularity conditions. Numerical results suggest the closed-form expansion formula up to the third order is accurate and fast for a broad range of diffusion models.

3 - Exact Sampling of Jump-diffusions
Dmitry Smelov, Stanford University, 141M Huang Engineering Center, Stanford, CA, 94305, United States of America, dsmelov@stanford.edu, Kay Giesecke

We present a method for the exact simulation of a skeleton, hitting time and other functionals of a 1-dimensional jump-diffusion with state-dependent drift, volatility, jump intensity and jump size. It requires the drift function to be C1, the volatility function to be C2, the intensity function to be locally bounded, and leads to unbiased simulation estimators of security prices, transition densities, and other quantities. We also discuss extensions of the method to the multidimensional case.

4 - Calibration of Stochastic Volatility Models: An Optimal Control Approach
Min Dai, Associate Professor, National University of Singapore, Dept. of Math, Singapore, Singapore, matdm@nus.edu.sg, Ling Tang, Xingye Yue

We develop an optimal control approach to recover the risk neutral drift term of stochastic volatility which is not assumed to have a special structure. Numerical results and empirical studies are presented. We also reveal that the risk neutral process of volatility recovered from market prices of options is indeed linearly mean-reverting.

■ WA69

69- Suite 314- Hyatt

Commodity Operations and Risk Management

Cluster: Risk Management

Invited Session

Chair: Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl

1 - Effect of Term Structure Model of Futures Price on Procurement Policies
Ankur Goel, Case Western Reserve University, Cleveland, OH, United States of America, axg312@case.edu, Genaro Gutierrez

We estimate the futures price of a contract whose maturity does not coincide with the maturity of the traded contracts on the commodity exchange. We propose Kalman filter based price models and regression analysis to predict the futures price. We show that statistically sophisticated Kalman filter price model are not always superior to the simple regression analysis. We develop procurement policies for a commodity processor and test them on out-of-sample futures price data.

2 - Integrated Options and Spot Procurement for Commodity Processors
Fehmi Tanrisever, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612, Netherlands, f.tanrisever@tue.nl, Ankur Goel

We show that under the value maximization framework and the assumption of perfect and efficient financial markets, options are more useful to mitigate demand risk than the price risk in the presence of logistical costs. We also identify conditions under which the options contracts are more valuable than the forward contracts for the firm.

3 - Transmission of Risk in a Supply Chain
Stathis Tompaidis, University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, stathis.tompaidis@mccombs.utexas.edu, Sheridan Titman, Hamed Ghoddusi

We develop an equilibrium model of price dynamics and study the transmission of shocks in a supply chain. For the case of crude oil to refined products we show that the relative volatilities of oil and gasoline and their correlation depends on the volatility of supply and demand shocks, elasticities, the convexity of the production function, and the competitiveness of the market. We extend our results to the case of the two-stage supply chain of crude oil to refined products to air travel.

4 - Capacity Management for Oilseeds Processors
Quang Dang Nguyen, Carlson School of Management, University of Minnesota, Twin Cities, United States of America, nguy1762@umn.edu, Tong Wang, Onur Boyabatli

This paper analyzes the capacity investment decisions of an oilseed pressing plant that uses a commodity input (oilseed) to produce a commodity output (crude vegetable oil) and a commodity byproduct (protein meal) in proportions. In a multi-period framework, we characterize the optimal capacity investment portfolio and the subsequent sourcing, processing and storage decisions under the input and the output spot price uncertainties.

■ WA70

70- Suite 316- Hyatt

Mobile and Crowd Market

Sponsor: Information Systems

Sponsored Session

Chair: Jeong-ha Oh, Assistant Professor, Georgia State University, 35 Broad St. NW, Atlanta, GA, 30303, United States of America, jhoh@gsu.edu

1 - An Empirical Study of Market Switching Behavior of Mobile App Developers

Young Jin Lee, University of Wisconsin at Green Bay, Cofrin School of Business, Green Bay, WI, 54311, United States of America, leey@uwgb.edu, Hossein Ghasemkhani, Yong Tan

Strategically, mobile app developers often change their free apps to be paid (or vice-versa) to increase their visibility and sales. Using Apple's AppStore daily app rank data, we explore how an app developer determines her instantaneous app's market, either in free app or paid app. We also examine how the duration of being either version in the AppStore is decided. Consequently, we estimate the effects of such strategic decisions on the performance of the apps in the AppStore.

2 - Feedback and Incentives in Crowdsourcing Contests: An Empirical Analysis

Jiahui Mo, University of Texas at Dallas, 800 W Campbell Road, SM 33, Richardson, TX, 75080, United States of America, jiahui.mo@utdallas.edu, Xianjun Geng, Zhiqiang Zheng

In a crowdsourcing contest, a seeker often provides performance feedbacks to solvers. This paper empirically investigates the relationship between seeker feedback and solver behavior. We find that feedback does not necessarily increase the overall efforts of participating solvers. Different types of feedback exhibit different effects in attracting new solvers. The effect of feedbacks is found to be contingent on the type of solvers.

3 - Online Product Reviews: Do They Benefit Retailers?

Young Kwark, University of Texas at Dallas, Richardson, TX, United States of America, youngk082@utdallas.edu

We study the effect of online product reviews on an online retailer that carries two substitutable products produced by different manufacturers. Products differ in qualities and fits to consumer needs. We find quality-information homogenizes consumers' utility differences between products and increases upstream competition. Fit-information heterogenizes consumers' estimated fits to products and softens upstream competition. We show when retailer benefits from reviews and how preference differs.

■ WA71

71- Suite 318- Hyatt

Social Network and Online Advertising

Contributed Session

Chair: Min Chen, Assistant Professor, George Mason University, School of Management, 4400 University Drive, MS 1B1, Fairfax, VA, 22030, United States of America, mchen15@gmu.edu

1 - The Online Personalisation Privacy Paradox in Social Commerce

Pei-Lee Teh, Senior Lecturer, Monash University, Jalan Lagoon Selatan, Selangor Darul Ehsan., Bandar Sunway, 46150, Malaysia, teh.pei.lee@monash.edu, Pervaiz K Ahmed

Social commerce providers recognise the importance of competitive strategies through online personalisation services. However, the benefits of online personalisation services can be outweighed by individual's privacy concerns. This study examines how social commerce users' personalisation value and privacy concern affect their perception of benefits, risks and value of information disclosure.

2 - Why do People Participate in Sponsored Social Media Groups?

Zsolt Ugray, USU, 3515 Old Main Hill, Logan, Ut, 84322, United States of America, zsolt.ugray@usu.edu, Eva Markos-Kujbus

Participation in social media has been widely studied. Less studied is the reason why people engage in activities of commercially sponsored groups. We present findings from our study of consumers' motivation for participation in sponsored Facebook groups.

3 - A Model to Maximize Profits for Small Businesses through LivingSocial and Other Deals Websites

Jorge Mejia, PhD Student, University of Maryland -Robert H. Smith School of Business, 10107 Baltimore Ave., Apt 4105, College Park, MD, 20740, United States of America, jmejia@rhsmith.umd.edu

Deals websites are increasing their popularity for small businesses in their efforts to recruit new customers. However, many of these small businesses begin offers on these deals websites without knowing whether it will be a profitable venture or not. Using the information of the deal, social media data from Facebook and Twitter, and a survey of the businesses, I create a profit model to simulate and optimize the conditions that allow a profitable outcome for small businesses.

4 - Volunteering 2.0: Systematic Investigation of Online Social Network use in Volunteer Organizations

Amy Connolly, University of South Florida, 16618 W. Course Dr, Tampa, FL, 33624, United States of America, ajconnol@usf.edu, Joni Jones

We present a series of studies we conducted to lay the groundwork for a ripe new area of research. Like volunteering, online social networks (OSNs) allow us to contact other people with similar interests, to learn about them, and to have our voices be heard. We provide voluntary organizations (who typically lag rather than lead new technology adoption) with a systematic investigation into how to strategically and efficiently employ OSNs to manage, recruit and retain quality volunteers.

5 - An Analysis of Click Fraud Auditing in Pay-Per-Click Advertising

Min Chen, Assistant Professor, George Mason University, School of Management, 4400 University Drive, MS 1B1, Fairfax, VA, 22030, United States of America, mchen15@gmu.edu, Varghese Jacob, Young Ryu, Suresh Radhakrishnan

Click fraud is a critical problem in pay-per-click advertising. While both service providers (SPs) and advertisers employ technologies to identify fraudulent clicks, prior work shows that they cannot be induced to make further improvements to their respective technologies. We consider the use of third party auditing to address this problem and examine whether the responsibility of payments helps induce both parties to work towards improving their technologies unilaterally.

■ WA72

72- Suite 322- Hyatt

Vehicle Routing Problems with Uncertainty or Dynamic Elements

Contributed Session

Chair: Stephan Meisel, Assistant Professor, University of Braunschweig, Carl-Friedrich-Gauss Department, Braunschweig, 38106, Germany, stephan.meisel@tu-bs.de

1 - Selective Vehicle Routing Problems under Uncertainty

Mahdieh Allahviranloo, Graduate Student, UCI, 2411 Verano Place, Irvine, CA, 92617, United States of America, mallahvi@uci.edu, Will Recker, Joseph Y.J. Chow

Three types of selective vehicle routing problems (VRPs) under uncertainty are presented: alpha-reliable, robust optimal, and a fuzzy selective vehicle routing problem (FSVRP). A small network is tested to demonstrate the superiority of selective methods over conventional ones under uncertainty in providing a spectrum of solutions. The FSVRP with time windows is solved with a genetic algorithm for a large network as a humanitarian logistics application, with promising results.

2 - Routing and Escorting Vehicles in Risky Transportation Networks

Ruben Yie Pinedo, Universidad del Norte-SUNY @ Buffalo, 69 edgebrook estates apt 4, Cheektowaga, NY, 14227, United States of America, ruben.yie@gmail.com, Rajan Batta, Moises Sudit

This paper discusses a multi-vehicle routing problem with multiple origins and destinations on a risky transportation network. Two cases are discussed: in the first one, vehicles are allowed to travel either with or without protection, whereas in the second case, the network contains zones in which local protection is mandatory. A time-constrained-shortest-path algorithm is used to solve the second case, whose solution is then used to solve the first case through a genetic algorithm.

3 - The Dynamic Dial-a-Chauffeur Problem

Niels Agatz, Rotterdam School of Management, Erasmus University, Burg. Oudlaan 50, Rotterdam, Netherlands, nagatz@rsm.nl, Johan Oppen, Jordan Srour

The dial-a-chauffeur service is a concept in which chauffeurs transfer customers from one location to another in their own car. The dial-a-chauffeur problem requires the routing of a crew of on-call chauffeurs between customer locations by company cars. A particularly dynamic application of this service focuses on people who must get themselves and their car home safely after drinking too much. In this study, we examine the impact of varying levels of real-time information on profitability.

4 - A Fresh Produce Distribution Problem with Multiple Compartments and Time Windows

Tsung-Sheng Chang, National Dong Hwa University, 1, Sec. 2, Da-Hsueh Rd., Shou-Feng, Hualien, Taiwan-ROC, ts@mail.ndhu.edu.tw

This research intends to solve a food retailer's fresh produce distribution problem. The problem involves the following main characteristics. First, fresh produce is highly perishable; its value is a function of time. Second, each retail store is associated with multiple time windows. Third, distribution trucks are equipped with multiple compartments. The goal of the distribution problem is to maximize the retailer's profit. This research proposes an optimization-based algorithm for the problem.

5 - A Meta-Waiting Strategy for Dynamic Routing of Service Vehicles

Stephan Meisel, Assistant Professor, University of Braunschweig, Carl-Friedrich-Gauss Department, Braunschweig, 38106, Germany, stephan.meisel@tu-bs.de, Uli Suppa, Dirk Mattfeld

We propose a meta-waiting strategy for dynamic vehicle routing problems with a fleet of vehicles, stochastic requests, service times and time windows. Each of the problems considered corresponds to a business application as, e.g., home grocery delivery or repair/maintenance services. Depending on the initial situation of each working shift, a waiting behavior is selected for each of the vehicles. Our results show this approach to outperform waiting strategies from the literature.

■ WA73

73- Suite 324- Hyatt

Scheduling in Jobs Shops and with Synchronization

Contributed Session

Chair: Junqiang Wang, Associate Professor, Northwestern Polytechnical University (NPU), Box 554,Northwestern Polytechnical Univ., 127 Youyi Xilu, NPU, Xi'an, 710072, China, siemwjq@gmail.com

1 - On the Scheduling Problem in Synchronizing Multiple Process Models

Qinhua Wang, Manager, Supply Chain Analytics Solutions, IBM Research-China, Building19, Zhongguancun Software Park, Haidian District, Beijing 100193, China, wangqinh@cn.ibm.com, Feng Chen, Changrui Ren

It's a big challenge to schedule the synchronization of multiple heterogeneous process models well when applying business process management techniques into practices. In the proposed approach, the multi-model synchronization problem is considered as a variant of the multi-commodity flow network problem. Through optimizing the flow of model modifications in the network, the synchronization of multiple process modules is scheduled aiming at improving efficiency and ensuring model consistence.

2 - A Flexible Dispatching Rule for Minimizing Tardiness in Job Shop Scheduling

Binchao Chen, TTU, 701 N Indiana Ave., Apt 621, Lubbock, TX, 79415, United States of America, binchao.chen@gmail.com, Timothy Matis

A dispatching rule called the Weight Biased Modified RRrule is developed that minimizes the mean tardiness of weighted jobs in a m-machine job shop. It is an extension the RRrule in that it maintains linear complexity and allows for job priorities. The WBMR rule allows for schedule biasing towards priority or throughput considerations while minimizing tardiness through the tuning of a single parameter, where such effect is measured by evaluating tardiness at different truncation thresholds.

3 - A Column Generation Algorithm for a Job Scheduling Problem with Synchronization Constraints

Michel Seixas, Student, University of Sao Paulo, Av. Prof. Mello Moraes 2231, São Paulo, SP, 05508030, Brazil, michel.povlovitsch@gmail.com, André Mendes

This study considers a job scheduling problem of the offshore oil industry. A job may demand multiple resources, whose allocations in time have to be synchronized, such as the anchor handling operation where up to 7 vessels are simultaneously requested to perform the task. This problem was modeled as a discrete time mathematical formulation and solved by a probabilistic constructive heuristic. A Column Generation algorithm was used to obtain excellent dual bounds.

4 - Job Shop Scheduling Optimization and Bottleneck Machine Identification

Junqiang Wang, Associate Professor, Northwestern Polytechnical University (NPU), Box 554, Northwestern Polytechnical Univ., 127 Youyi Xilu, NPU, Xi'an, 710072, China, siemwjq@gmail.com, Jian Chen, Ting Qu, George Q. Huang, Shudong Sun

Bottleneck identification and utilization in job shop is more difficult than flow shop. The traditional approaches treated the issue as two separated sub-parts and optimized respectively, which may gain fake bottleneck and locally optimal schedule. We considered the two parts as a whole problem and solved simultaneously. An integrated approach based on immune algorithm and multiple attribute decision making is presented, and 24 benchmarks of JSP are used to verify the approach's effectiveness.

Wednesday, 11:00am - 12:30pm

■ WB01

01- West 101- CC

Heuristics for Global Optimization, and Real-World Applications

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Michael Hirsch, Raytheon Company, Orlando, FL, United States of America, mjh8787@ufl.edu

1 - An Ortho-Normalized Continuous GRASP

Michael Hirsch, Raytheon Company, Orlando, FL, United States of America, mjh8787@ufl.edu, Daniel Schroeder

In this research, we discuss recent extensions to Continuous GRASP, a heuristic for continuous global optimization. We test these extensions on numerous standard test functions, as well as some difficult real-world optimization problems.

2 - Comparing Production Planning Policies for the Integration of Lot Sizing and Scheduling Decisions

Martin Ravetti, Federal University of Minas Gerais, Avenida Antonio Carlos, 6627, Pampulha, Belo Horizonte, Brazil, gravetti.martin@gmail.com, Bernardo Furtado, Maurìcio Souza

We deal with production planning problem integrating lot sizing and scheduling decisions. The problem is based on a real case and two integration procedures combining heuristics and exact approaches are compared. A set of instances considering a flowshop scenario is generated to test and compare the proposed metodologies.

3 - Analysis and Optimization of Renewable Energy Integration for Hybrid Power System Design

Brandon Ha, Graduate Student, Southern Methodist University, 3101 Dyer Street, Dallas, TX, 75202, United States of America, dha@mail.smu.edu, Eli Olinick

Renewable energy is the key to creating a green, sustainable future. In our study, a comprehensive system modeling approach is taken to identify the optimal system configuration of the power system integrated with renewable energy sources. An MIP formulation of the problem is developed to minimize the system life-cycle cost. Two mathematical programming-based heuristics are proposed to solve this problem efficiently.

4 - An Optimal Sample Allocation Strategy for Partition-based Random Search

Weiwei Chen, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, chenw@ge.com, Chun-Hung Chen, Siyang Gao, Leyuan Shi

Partition-based random search is a class of algorithms for global optimization. The solution space is partitioned into subsets which are sampled and evaluated, and one subset is then determined to be promising for further partitioning. We propose an optimal strategy for allocating samples to subsets so that the probability of correctly selecting the promising subset is maximized. It is effective in improving the performance of random search algorithms by most efficiently utilizing the samples.

5 - On the Solution of DMDGPs Containing Nuclear Magnetic Resonance Data

Andrea Cassioli, Research Fellows, Department of Radiation Oncology-Massachusetts General Hospital, 30 Fruit Street, Boston, MA, 02114, United States of America, cassioliandre@gmail.com, Carlile Lavor, Leo Liberti, Antonio Mucherino

The Discretizable Molecular Distance Geometry Problem (DMDGP) consists of a subclass of distance geometry problems related to molecules that can be discretized. The Branch & Prune (BP) algorithm has been conceived for exploiting the particular combinatorial structure of DMDGPs, and is currently the only algorithm for distance geometry that is able to enumerate all solutions to the problem. The strong point of BP is its pruning phase, which allows us to remove large parts of the search space and to focus the search on its feasible parts. Our most recent efforts are devoted to the development of new pruning devices, to be used during the execution of BP, that are based on information obtained through experiments of Nuclear Magnetic Resonance.

■ WB02

02- West 102 A- CC

Data-driven Decision Analysis

Sponsor: Decision Analysis

Sponsored Session

Chair: Debarun Bhattacharjya, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, debarunb@us.ibm.com

1 - Can We Build Bayesian Networks from Unstructured Text?

Lea Deleris, IBM, Paris, 75015, France, lea.deleris@ie.ibm.com, Brian White, Lamia Tounsi

Bayesian networks (BNs) are most often build either from experts' opinions or when available using historical data. We explore a less common option: leveraging existing literature. Our research objective is to facilitate building BNs by leveraging Natural Language Processing techniques to extract relevant pieces of information. In particular, we seek to extract and aggregate dependence and independence information (for structure) and probability statements (for parameters).

2 - Decision Making in a World with Large Datasets

Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61822, United States of America, aliabbas@illinois.edu

As more data is becoming available through the internet and other resources, and as computational efficiency is becoming ever increasing, there is a need to make several distinctions and algorithms that can help in decision making with large datasets. There is also a need to filter out arbitrary methods. I discuss several discussions relating data to information to decision making.

3 - Impact on Decision Analysis of Minimizing Data Error Margins and Distortion

Orhan Güvenen, Professor, Bilkent and Paris Duphine Universities, Bilkent Unv. SAL, LC117, 06800 Bilkent, Ankara, 06800, Turkey, gorhan@bilkent.edu.tr

The increase in quantity of the information available to access does not automatically guarantee the increase in quality and authenticity of the information. Dominantly this information is open to information distortion and to non-negligible error margins. In decision analysis high error margins and information distortion can create a substantial biased structure and very high alternative costs, it is a necessary condition to minimize error margins,information distortion, endogenize ethics.

4 - Computational Creativity: A Two-attribute Search Technique

Debarun Bhattacharjya, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, debarunb@us.ibm.com, Lav Varshney, Florian Pinel, Yi-Min Chee

Computational creativity is a multidisciplinary subject that studies how machines can help design artefacts that might be perceived by humans to be creative. We explore the use of search techniques based on two key attributes, quality and novelty, and study Bayesian techniques to measure novelty. We propose a methodology for designing new artefacts starting from a database of extant works, and illustrate the concepts using an example.

■ WB03

03- West 102 B- CC

Topics in Decisions Analysis

Sponsor: Decision Analysis

Sponsored Session

Chair: Onesun Yoo, University College London, Gower Street, London, WC1E 6BT, United Kingdom, onesun.yoo@ucl.ac.uk

1 - Search Before Tradeoffs are Known

Otso Massala, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, otso.massala@insead.edu, Ilia Tsetlin

We consider a setting where the decision maker searches (with recall) for multiattribute alternatives but, while searching, does not know exactly his further tradeoffs (preference) among different attributes. After the search is completed, the decision maker learns his tradeoff's and selects the best alternative out of the discovered ones. We study the optimal search strategy in this and related settings.

2 - Decision Theory and Imperfecting Information

Chris Keller, Assistant Professor, East Carolina University, College of Business, 3136 Bate Building, Greenville, NC, 27858, United States of America, kellerc@ecu.edu, Scott Dellana

In decision theory, a simple expected value of perfect information is the weighted maximum outcome for each random variable less the maximum expected value of the alternatives. This paper considers varieties of inverted formulations for disinformation, i.e., the maximum expected value of the alternatives less the probabilistically weighted minimums of the outcomes for each random variable. Three topical cases are considered for the valuation and exploitation of disinformation.

3 - Analyzing Scrip Systems: Selection Rules and Optimality

Kris Johnson, PhD Candidate, Massachusetts Institute of Technology: Operations Research Center, 154 Cedar Street, #4-3, Somerville, MA, 02144, United States of America, krisdj@mit.edu, Peng Sun, David Simchi-Levi

Scrip systems provide a non-monetary trade economy for exchange of resources. We model a scrip system as a stochastic game and study system design issues on selection rules to match trade partners over time. We show the optimality of one rule in terms of maximizing social welfare, while satisfying individual rationality constraints. We also investigate the optimal number of scrips to issue and find that there is an upper bound (possibly infinity) on the number of scrips allowed in the system.

4 - Employee Retention Strategies of Entrepreneurial Firms under Uncertainty in Employee Capability

Onesun Yoo, University College London, Gower Street, London, WC1E 6BT, United Kingdom, onesun.yoo@ucl.ac.uk, H. Dharma Kwon

We study the employee retention strategy of growth-oriented entrepreneurial firms in which the employee's capability is unknown to both the firm and the employee. We model this situation as a real options game between the firm and the employee, and we obtain a Markov perfect equilibrium (MPE) characterized by the employment termination strategies of the two players. Our findings suggest that firms should assign employees with highly uncertain capabilities to tasks with high noise levels.

■ WB04

04- West 102 C- CC

Theory and Application of Data Envelopment Analysis

Contributed Session

Chair: Nasim Sabounchi, Virginia Technical University, 7054 Haycock Road, Room 433, Falls Church, VA, 22044, United States of America, sabounchi@vt.edu

1 - Evaluating Environmental Efficiency in DEA: Some Critical Issues and Solutions

Chien-Ming Chen, Nanyang Business School, Nayang Technological University, 50 Nanyang Ave., Singapore, 639798, Singapore, cmchen@ntu.edu.sg

This paper analyzes previously overlooked limitations of the existing environmental efficiency models under the weak disposability assumption (WDA). Specifically, we show that WDA can cause non-monotonicity in undesirable outputs (firms may benefit from polluting more and vice versa), strongly dominated firms may be identified as efficient, and firms' efficiency scores are computed based on strongly dominated points. Both numerical and analytical results are provided.

2 - Comparison of Efficiency of Czech Banks using Two-stage DEA Models

Josef Jablonsky, Professor, University of Economics, Prague, W. Churchill Sq. 4, Praha 3, 13067, Czech Republic, jablon@vse.cz

Data envelopment analysis (DEA) is a non-parametric technique for evaluation of relative efficiency of decision making units described by multiple inputs and outputs. The paper deals with efficiency evaluation of Czech banks using two-stage DEA models. First stage evaluates production efficiency and the second one profit efficiency. The results given by two single DEA models for the first and second stages and then by network model are presented and compared.

3 - Assessing the Efficiency of Philippine Public Schools using Data Envelopment Analysis

Brian Gozun, De La Salle University, 2401 Taft Avenue, Manila, Philippines, brian.gozun@dlsu.edu.ph

This study assesses the efficiency of Philippine public school using data envelopment analysis. As the country has increased the number of required schooling, there is a need to determine the efficiency of public schools in the provision of learning and instruction. Inputs would take into account faculty complement and learning resources while outputs would include test scores. This study would be useful in benchmarking best practices as well as improving the outcomes of low-performing schools.

4 - Improving Delinquent Loan Processing Efficiency via Efficient Assignments in a Large US Bank

Aysegul Peker, SAS, Cary, NC, United States of America, Aysegul.Peker@sas.com

Due to recent regulation changes in the US, the number and variety of processes Customer Relationship Managers (CRMs) need to perform for delinquent mortgage loans has increased. In this talk, we investigate the assignment problem of a variety of processes to a variety of resources to improve loan processing in a large US bank. We present a model and different approaches to solve this model. We show improvements of this approach compared the traditional manual processes.

5 - Intensity Models and Transition Probabilities for Credit Card Loan Delinquencies

Jonathan Crook, Director, Credit Research Centre, University of Edinburgh Business School, University of Edinburgh, 29 Buccleuch Place, Edinburgh EH8 9JS, United Kingdom, j.crook@ed.ac.uk

We estimate the probability of delinquency and default for a sample of credit card loans using intensity models, via semi-parametric multiplicative hazard models with time-varying covariates. It is the first time these models, previously applied for the estimation of rating transitions, are used on retail loans. Four states are defined in this non-homogenous Markov chain: up-to-date, one month in arrears, two months in arrears, and default; where transitions between states are affected by individual characteristics of the debtor at application and their repayment behaviour since. These intensity estimations allow for insights into the factors that affect movements towards (and recovery from) delinquency, and into default (or not). Results indicate that different types of debtors behave differently while in different states. The probabilities estimated for each type of transition are then used to make out-of-sample predictions over a specified period of time.

■ WB05

05- West 103 A- CC

Computer Experiments

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Roshan Vengazhiyil, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu

1 - Computationally Efficient use of Derivatives in Emulation of Complex Computational Models

Brian Williams, Los Alamos National Laboratory, Bikini Atoll Road; MS F600, Los Alamos, United States of America, brianw@lanl.gov, Peter Marcy

We will investigate the use of derivative information in complex computer model emulation when the correlation function is of the compactly supported Bohman class. To this end, a Gaussian process model similar to that used by Kaufman et al. (2011) is extended to a situation where first partial derivatives in each dimension are calculated at each input site (i.e. using gradients). The efficacy of the proposed method is studied via simulation and a nuclear reactor code.

2 - Tapered Correlation Matrix Preconditioning for Fast Approximate Kriging

Lulu Kang, Assistant Professor, Department of Applied Mathematics, Illinois Institute of Technology, 10 W 32nd Street, E1-208, Chicago, IL, 60615, United States of America, lkang2@math.iit.edu

Kriging has been very popular for analyzing computer experiments due to its accurate prediction. But it also needs extensive computation due to the matrix inversion involved in the predictor. We propose using the preconditioning approach to approximate the matrix inversion in the kriging predictor. How to construct the preconditioning matrix is crucial to the accuracy and efficiency of the approximate kriging. Here we suggest using the tapered correlation matrix as the preconditioning matrix.

3 - Principles of Experimental Design for Deterministic Simulation

Benjamin Haaland, Assistant Professor, Duke-NUS, 8 College Road, Singapore, 169857, Singapore, benjamin.haaland@duke-nus.edu.sg

Simulations are used to study real systems for which real experimentation is not feasible. In the usual situation where runs of the simulation take a non-negligible amount of time and computing, experimental design is extremely important in gaining high quality information from simulations. Principles of experimental design will be proposed and justified which ensure high numeric accuracy, high nominal accuracy, and accurate parameter estimates for deterministic simulations.

4 - Tractable Functional Response Modelling with Processes with Non-Separable Covariance Functions

Matthew Plumlee, PhD. Student, The Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, mplumlee@gatech.edu, Roshan Vengazhiyil

Gaussian Process models have become increasingly popular to model functional responses. However, fitting these models requires computationally expensive matrix inversion or decomposition, a problem exacerbated with functional responses. Separability and stationarity assumptions on the covariance function of the GP model to ease the computational burden. This work proposes a method to model these functions without the separability assumption while maintaining the computational advantages.

■ WB06

06- West 103 B- CC

Joint Session SIM/HAS: Modeling and Simulation of Healthcare Systems

Sponsor: Simulation & Health Applications Society

Sponsored Session

Chair: Eduardo Perez, Assistant Professor, Texas State University, Roy F. Mitte Complex, 749 N Comanche St., San Marcos, TX, 78666, United States of America, eduardopr@neo.tamu.edu

1 - Application of Uncertainty Models to Evaluate Laboratory Assay Calibration Protocols

Varun Ramamohan, Purdue University, 315 N Grant St., West Lafayette, IN, 47906, United States of America, vramamoh@purdue.edu, George Klee, Yuehwern Yih, James Abbott

Laboratory protocols used to calibrate clinical chemistry systems affect test result quality. System uncertainty models are used to evaluate such protocols: calibration using mean of replicate measurements; calibration based on acceptance when quality control specimens were within one standard deviation of target. The effect of calibrator concentrations on assay uncertainty was studied, and calibrator concentrations minimizing uncertainty at specific concentration levels were identified.

2 - A Simulation Study of an Outpatient Cancer Clinic

David Claudio, Assistant Professor, Montana State University, 220 Roberts Hall, Bozeman, 59717, United States of America, david.claudio@ie.montana.edu, Mahmudur Rahman, Annali Huggins

The Bozeman Deaconess Cancer Center provides infusion services to a sector of the state of Montana. It has 7 different types of patient flow, different process times and different schedule times for each resource. The objective of this study was to identify how to simulate such a complex system. The simulation process of cancer center began with a simple model and complexity was added incrementally. As the model increased in complexity, it became more representative of actual system.

3 - Role of Demand Variability, Information Sharing & Resource Flexibility in Coordinating Patient Flow

Vikram Tiwari, Assistant Professor & Director Surgical Business Analytics, Vanderbilt University Medical Center, Nashville, TN, United States of America, vikram.tiwari@Vanderbilt.Edu, Munirpallam Venkataramanan, Kurt Bretthauer

Using simulation modeling, patient flows in a hospital are analyzed under varying levels of information sharing, demand variability and resource flexibilities. It is found that increasing levels of information sharing can sometimes be to the detriment of operational performance, especially if the system has too much built-in resource flexibility.

4 - Integrating Mathematical Optimization in DEVS for Nuclear Medicine Patient and Resource Scheduling

Eduardo Perez, Assistant Professor, Texas State University, Roy F. Mitte Complex, 749 N Comanche St., San Marcos, TX, 78666, United States of America, eduardopr@neo.tamu.edu

Nuclear medicine uses advanced technology and radiopharmaceuticals for the diagnosis and treatment of patients. Procedures in nuclear medicine are multistep, and have to be performed under strict time windows constraints. In this work, we develop and implement a DEVS model of a nuclear medicine clinic that uses CPLEX to optimize patient and resource schedules. We report on computational results based on a real clinic, historical data, and both patient and management performance measures.

■ WB07

07- West 104 A- CC

Data-driven Simulation Modeling

Sponsor: Data Mining

Sponsored Session

Chair: Durai Sundaramoorthi, Lecturer of Management, Olin Business School, Washington University in St. Louis, St. Louis, MO, United States of America, dsundaramoorthi@gmail.com

1 - A Data-driven Predictive Analytics Approach for Transportation Portfolio Management

Durai Sundaramoorthi, Lecturer of Management, Olin Business School, Washington University in St. Louis, St. Louis, MO, United States of America, dsundaramoorthi@gmail.com, Aihong Wen

Classification and Regression Trees (CART) is a method of predictive analytics that attempts to predict or classify using a set of continuous or categorical variables. In this research, we investigate the predictability of a transportation portfolio with CART by simulating the portfolio performance. We analyze the daily performance of other markets in relation to the transportation portfolio.

2 - Using Data Effectively in Risk Analysis using Monte Carlo Simulation

Samik Raychaudhuri, Oracle Americas, 2033 N Fork Drive, Lafayette, CO, 80026, United States of America, samikr@gmail.com

In this presentation, we will discuss various roles data can play when running a Monte Carlo simulation analysis, starting from data collection, distribution modeling, and sensitivity analysis. We will also discuss a few data-cleansing procedures, and some best-practices. We will use Oracle Crystal Ball as an example implementation.

3 - Simulation and Data-integrated Decisions for Revenue Maximization of Coalmines

Sai Srinivas Nageshwaraniyer, Research Assistant, The University of Arizona, 1127 E James E Rogers Way, P.O. Box 210020, Tucson, AZ, 85721, United States of America, ngsaisrinivas@gmail.com, Chao Meng, Young-Jun Son, Sean Dessureault

We present a simulation-based approach for material handling system (MHS) to maximize revenue of a coalmine. A Markov chain and Taguchi design of experiments is respectively used to mimic and identify equipment conditions based on historical data. A simulation model of MHS along with heuristics considering the Markovian property of equipment is used to obtain best settings for equipment scheduling. Real data from a large coalmine is used to demonstrate the benefits of the proposed approach.

■ WB08

08- West 104 B- CC

Joint Session SPPSN/ENRE-Environment: Sustainability Planning

Sponsor: Public Programs, Service and Needs & Energy, Natural Res & the Envi/ Environment and Sustainability

Sponsored Session

Chair: Erin Baker, University of Massachusetts, Amherst, MA, United States of America, edbaker@ecs.umass.edu

1 - Making Decisions with Multiple Attributes: A Case in Sustainability Planning

Joe Hahn, Associate Professor, Pepperdine University, Malibu Campus, Malibu, CA, United States of America, Joe.Hahn@pepperdine.edu

Decisions involving issues of sustainability tend to include an array of objective attributes along with subjective value judgments. In this paper, we present a Multi-Attribute Decision Analysis model which was developed to assist Pepperdine University with prioritizing a number of competing projects to address a goal of developing a more sustainable energy policy on campus.

2 - Estimating Costs of Self-sustaining Logistics Networks

Eva Regnier, Naval Postgraduate School, 699 Dyer Road, Monterey, CA, 93943, United States of America, eregnier@nps.edu, Jay Simon

New logistics networks in disaster response and undeveloped military theaters may need to be self-sustaining. We present methods for 1) designing a distribution network based on simple planning scenarios and 2) estimating costs to deliver fuel and other supplies, for use in evaluating conservation and alternative energy investments.

3 - Sustainability Incorporation in Modeling an Oil Supply Chain: A Case Study of Tullow Ghana

Iddrisu Awudu, North Dakota State University, 26 University Village, Fargo, ND, 58102, United States of America, Iddrisu.Awudu@my.ndsu.edu, Jun Zhang

This presentation will seek to integrate sustainability in modeling a crude oil supply chain setting. Profit maximization incorporates economic, social and environmental factors such as job creation, corporate responsibility, and carbon impact respectively. A chance constraint programming is used to measure the level of CO2 emissions allowable into the environment. The results conclude that incorporating sustainability reduces how much the firm can allocate to corporate responsibility programs.

4 - Developing Computational Model Framework for Sustainability Planning of Eco-Industrial Network

Anthony Halog, Assistant Professor, University of Maine, 1263 Western Avenue, Orono, ME, 04469, United States of America, anthony.halog@maine.edu, Najet Bichraoui

Attaining industrial sustainability requires collaborative efforts from participating agents toward common goals such as resource conservation, low carbon emissions, production efficiency, and economic viability. This study aims to operationalize the notion of system sustainability by developing a framework for computational modeling and design of an industrial ecology-modeled forest biorefinery.

■ WB09

09- West 105 A- CC

AHP/ANP for Sustainability

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Birsen Karpak, Professor of Management, Youngstown State University, One University Plaza, WCBA 3303, Youngstown, OH, 44555, United States of America, bkarpak@ysu.edu

1 - Information Systems for Sustainability

Steve Taraszewski, Senior Research Analyst, ABD, Youngstown State University, One University Plaza, Engineering Technology Department, Youngstown, OH, 44555, United States of America, sataraszewski@ysu.edu, Birsen Karpak

In this paper we explore enabling effect of information systems (IS) on triple bottom-line, economic, environmental and social sustainability. Earlier research identified the need for research methodologies that account for uncertainty and feedback. Analytical Network Process (ANP) methodology based benefits, opportunities, cost and risk framework we propose fills this gab and can evaluate both quantitative and qualitative sustainability indicators identified in literature.

2 - An Analytic Model to Evaluate a 3PL Partner

Ozden Bayazit, Associate Professor of Supply Chain Management, Central Washington University-Lynnwood, 20000 68th Avenue W., Lynnwood, WA, 98036, United States of America, bayazito@cwu.edu, Birsen Karpak

This study extends a framework, a simple Analytical Network model, developed in literature to evaluate third party logistic companies. We contend that Benefits Costs Opportunities Risks model will represent the reality better. In addition, the proposed framework address triple bottom line, People, Planet, and Profit, therefore it is a framework for sustainable supply chains.

3 - Sustainable Supply Chains: Contributions from MCDM

Birsen Karpak, Professor of Management, Youngstown State University, One University Plaza, WCBA 3303, Youngstown, OH, 44555, United States of America, bkarpak@ysu.edu, Carol Lamb

Supply chains play a significant role in the global knowledge based economy. There has been numerous papers written and research done in the area of sustainable supply chain management (SSCM). The purpose of this paper is to explore contributions of MCDM to this domain. Taxonomy of the methodologies used will be given. Our initial research indicates that Analytical Hierarchy process (AHP)/ Analytical Network Process (ANP) are among the most applied methodologies of MCDM to this field.

4 - Sustainability for a Manufacturing SME in Ohio: Women Perspective

Anne McMahon, Professor Emeritus, Youngstown State University, One University Plaza, WCBA 3303, Youngstown, OH, 44555, United States of America, ammcmahon@ysu.edu, Birsen Karpak

This study implements an Analytical Network Process (ANP) based framework developed for small /medium manufacturing enterprises to prioritize sustainability measures to a woman owned manufacturing company in Ohio. A female expert has judged the impact of each factor on other success factors for her business. Sustainability measures are prioritized. The study results will guide the authors as they pursue distinctive issues related to women owned small businesses in Ohio.

■ WB11

11- West 105 C- CC

Equilibrium Problems and Variational Inequalities: Hierarchy, Dynamics and Uncertainty

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Uday Shanbhag, University of Illinois at Urbana-Champaign, 206 Transportation Building, Urbana, IL, United States of America, udaybag@illinois.edu

1 - Differential Variational Inequalities and Differential Nash Games

Jong-Shi Pang, Department Head and Caterpillar Professor, University of Illinois at Urbana-Champaign, Industrial and Enterprise Systems Engin, Urbana, IL, 61801, United States of America, jspang@illinois.edu

We examine the relationship between differential variational inequalities and differential Nash games and provide some recent results.

2 - Solvability of Stochastic Variational Inequalities

Uma Ravat, University of Illinois at Urbana-Champaign, 406 Transportation Building, Urbana, IL, United States of America, ravat1@Illinois.edu, Uday Shanbhag

The analysis of the variational conditions in stochastic regimes is challenging. We present a framework for the tractable verification of solvability in stochastic regimes ; importantly, this avenue does not necessitate the evaluation of an expectation or its derivatives. Extensions to nonsmooth regimes, stochastic quasi-variational inequalities and stochastic complementarity problems are also presented. The ideas are illustrated with practical examples Nash-Cournot games.

3 - Confidence Intervals for Some Learning Problems

Shu Lu, University of North Carolina at Chapel Hill, 355 Hanes Hall, Cb#3260, Dept. of Stat & OR, UNC, Chapel Hill, No, 27599, United States of America, shulu@email.unc.edu

Statistical learning problems extract patterns from sample data. Variance in sample data clearly has an effect on the pattern learned. We discuss a method to establish confidence intervals on the learned pattern. This method is based on a general method on confidence regions of stochastic variational inequalities.

4 - Distributed Adaptive Steplength SA Schemes for Cartesian Stochastic Variational Inequality Problems

Farzad Yousefian, PhD Candidate, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, yousefi1@illinois.edu, Angelia Nedich, Uday Shanbhag

We consider a class of cartesian stochastic variational inequality problems. Motivated by the naive choice of stepsizes in stochastic approximation (SA) methods, we provide almost-sure convergence theory for a distributed SA scheme with an adaptive steplength rule. Additionally, to address problems where the mapping is not Lipschitz, we present a distributed local randomization scheme that constructs a Lipschitzian approximation. Preliminary numerical results are seen to be promising.

■ WB12

12- West 106 A- CC

Covering and Packing in IP: Novel Extensions and Techniques

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Dimitri Papageorgiou, PhD Candidate, Georgia Tech, 765 Ferst Ave, Atlanta, GA, 30332, United States of America, djpapag@gatech.edu

1 - Probabilistic Set Covering with Correlations

Dimitri Papageorgiou, PhD Candidate, Georgia Tech, 765 Ferst Ave., Atlanta, GA, 30332, United States of America, djpapag@gatech.edu

We consider two variants of a probabilistic set covering (PSC) problem and formulate deterministic MIP models for distributionally-robust PSC problems with correlated uncertainties. By exploiting the supermodularity of certain substructures and analyzing their polyhedral properties, we develop strong valid inequalities to strengthen the formulations. Computational results illustrate the success of our approach.

2 - Deterministic Bounds for Probabilistic Set Multi-Cover Problems

Feng Qiu, Georgia Tech, 350516 Georgia Tech Station, Atlanta, GA, 30332, United States of America, fqiu@gatech.edu, Shabbir Ahmed, Santanu Dey

We consider a type of probabilistic set multi-cover problems where each element is to be covered by at least k sets with a certain prescribed probability. We use the LP-based probability bounds to derive inner and outer deterministic approximations. Preliminary computational results are presented.

3 - Extending Benders Decomposition to Integer Programs

D.A. Tony Tarvin, PhD Student, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, dtarvin@mines.edu, R. Kevin Wood, Alexandra Newman

We lay new groundwork for extending Benders decomposition to integer programs. Initially specializing to a set-packing problem, we relax a subset of the binary variables and solve the resulting mixed integer program with Benders decomposition. We assess methods for partitioning the binary variables into "binary" and "relaxed," and explore means for recovering integer-feasible solutions to the original model. We provide preliminary results comparing our decomposition to standard branch-and-bound.

4 - Lifting Generalized Intersection Cuts

Egon Balas, Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15206, United States of America, eb17@andrew.cmu.edu, Selvaprabu Nadarajah

Generalized or look-ahead intersection cuts are obtained by first generating a collection B of points on the boundary of a lattice-free convex set, then using the reverse polar of B to generate a set of deep cuts. Assuming that these cuts are generated in a subspace, we examine ways of lifting them into the full space.

■ WB13

13- West 106 B- CC

Integer Programs with Knapsack and Assignment Problem Connections

Contributed Session

Chair: Alireza Naimi, PhD Applicant, The University of Memphis, Department of Civil Engineering, 104 Engineering Science, Memphis, TN, 38152, United States of America, anaimi@memphis.edu

1 - Ideal Representations of Lexicographic Orderings and Base-2 Expansions of Integer Variables

Frank Muldoon, Clemson University, Martin Hall, Clemson, SC, 29634, United States of America, fmuldoo@clemson.edu, Warren Adams, Hanif D. Sherali

We use minimal cover inequalities to define the convex hulls of special sets of binary vectors that are lexicographically lower and upper bounded by given vectors, and use these convex hulls to obtain ideal representations for base-2 expansions of bounded integer variables. Our arguments afford a new perspective on, and extend convex hull results for, binary knapsack polytopes having weakly super-decreasing coefficients.

2 - A Solution Approach for Cardinality Constrained Knapsack Problem

Gigyoung Park, Course in PhD, Korea University, Anamdong 5 Ga, Sungbuk Gu, Seoul, Korea, Republic of, shadowpp@korea.ac.kr, Youngho Lee, Chanwoo Park, Gilhyun Do

We deal with the cardinality constrained knapsack problem. Combining the reformulation-linearization technique (RLT), we devise a cut generation algorithm for enhancing the LP relaxation lower bounds. Also we propose a cut generation scheme based on constructing a partial convex hull representation for a given 0–1 mixed-integer programming problem. Computational results provide insights into implementing the proposed cutting plane methodology.

3 - An Integer Knapsack-based Heuristic Algorithm for Paper Cutting Optimization

Kyungdoc Kim, POSTECH, San 31, Hyoja, Namgu, Pohang, 790-784, Korea, Republic of, kdoc85@postech.ac.kr, Taehun Kim, Hyunbo Cho, Byung-In Kim

In this talk, we introduce a real-world multi objective paper cutting optimization problem, in which efficient and effective cutting patterns are designed to produce small rolls and sheets from large paper rolls. The problem is formulated to maximize both pattern and roll width, with several constraints considered, such as resource capabilities, order characteristics. An integer knapsack-based heuristic algorithm is proposed and its performance is demonstrated with real data.

4 - Discrete vs Continuous Time Formulation for the Two Dimension Assignment Problem

Alireza Naimi, PhD Applicant, The University of Memphis, Department of Civil Engineering, 104 Engineering Science, Memphis, TN, 38152, United States of America, anaimi@memphis.edu, Mihalis Golias, Georgios Saharidis

Alireza Naimi, Georgios K.D. Saharidis, Mihalis Golias Two dimension (i.e. space and time variables) assignment problems (2DAPs) arise in different situations and are a well-studied in combinatorial optimization. Limited published literature has been proposed on the use of discrete time and space representations. This research focuses on the former and provides a comparison of the discrete and continuous representation of time in 2DAPs.

■ WB14

14- West 106 C- CC

Recent Developments in Scheduling: Theory and Practice

Cluster: Scheduling and Project Management

Invited Session

Chair: Tolga Aydinliyim, Assistant Professor, University of Oregon, Lundquist College of Business, 1208 University of Oregon, Eugene, OR, 97403, United States of America, tolga@lcbmail.uoregon.edu

1 - Balancing Production, Inventory, and Delivery Costs in Paper Manufacturing

Neil Geismar, Texas A&M University, 320 Wehner, College Station, TX, United States of America, NGeismar@mays.tamu.edu, Nagesh Murthy

Supply chain scheduling in the paper industry minimizes the sum of production, inventory, and delivery costs. A single plant serves multiple clients. Each customer's order contains multiple jobs; each job has its own weight and width. The plant combines jobs from different customers into production sets of uniform weight and limited total width. Distribution is via a limited number of capacitated railcars. Inventory is expensive, because of product's bulk.

2 - Optimal Scheduling of Products with Two Subassemblies and Changeover Cost

Feng Zhou, Student, Indiana University Bloomington, 1309 E. 10th Street, Bloomington, IN, 47405, United States of America, fengzhou@indiana.edu, James Blocher, Sebastian Heese, Xinxin Hu

We consider the problem of scheduling products with two subassemblies on a common resource, where changeovers incur fixed costs. The objective is to minimize the weighted sum of flow time and changeover cost. We provide properties of optimal solutions and characterize optimal schedules. Our results have interesting implications for practice, primarily that the structure of the optimal schedule is robust to changes in demand.

3 - Assessing Appointment Systems' Operational Performance with Policy Targets

William Millhiser, Assistant Professor, Baruch College, City University of New York, One Bernard Baruch Way, Box B9-240, New York, NY, 10010, United States of America, william.millhiser@baruch.cuny.edu, Emre Veral, Benedetto Valenti

We propose a paradigm shift in performance evaluation of outpatient appointment schedules. Our research addresses the traditional dilemma between patient and provider delays, but with operational performance metrics that assess probabilities of exceeding established thresholds instead of optimizing presumed cost functions. Our analysis reveals serious shortcomings in traditional schedules; the managerial decision space so far investigated in the literature is inadequate for operational control.

4 - Aggregate Planning of Fleet Deployment for Liner Shipping

Zhou Xu, Department of Logistics and Maritime Studies, Faculty of Business, The Hong Kong Polytechnic University, PQ506, The Hong Kong Polytechnic Univers, Hong Kong, Hong Kong-PRC, lgtzx@polyu.edu.hk, Kevin Li, Jun Xia

We present an aggregate planning model to deploy container ships to liner shipping services rotated around different regions of the world, with an aim to maximize the total profit. It takes into account a joint optimization of decisions on the numbers and speeds of ships deployed for each service, together with the cargo flows. The model can be solved to optimal for up to five regions, which are commonly faced by practitioners in liner shipping.

5 - Solving the Turkish Crew Scheduling Problem

Orsan Ozener, Ozyegin University, Department of Industrial Engineering, Istanbul, Turkey, orsan.ozener@ozyegin.edu.tr, Melda Ormeci Matoglu, Gunes Erdogan, Mohamed Haouari

Crew scheduling problem is considered to be one of the most challenging problems in airline planning. Problems for the Turkish airline companies are different than those faced by the North American and European companies. The Turkish crew scheduling problem has its specific properties such as fixed crew salaries, only one crew base, and other considerations besides cost minimization. We develop heuristic based novel solution methods to address Turkish non-generic crew scheduling problem.

■ WB15

15- West 202- CC

EZ Website Management Tools and Hosting for INFORMS Communities

Cluster: INFORMS

Invited Session

Chair: Shirley Mohr, INFORMS, 7240 Parkway Drive, Hanover, MD, 21076, United States of America, shirley.mohr@informs.org

1 - EZ Publish - Website Management Tools and Hosting for INFORMS Communities

Shirley Mohr, INFORMS, 7240 Parkway Drive, Hanover, MD, 21076, United States of America, shirley.mohr@informs.org

Learn about 'EZ' Website Management Tools and Hosting for INFORMS Communities This session is for INFORMS Community officers and webmasters and introduces EZ Publish, an easy but powerful web management tool for quickly creating and updating web sites without the need for web design experience or software. All you need is an internet connection and a login and you can get started. Any INFORMS Community or Subdivision that wishes to utilize a ready-made INFORMS template and intuitive tools to create and maintain their website should attend. Special features include blogs, forums, password-protected areas, real-time twitter feeds, and analytics reports about your site.

■ WB16

16- West 207- CC

Tutorial Maritime Shipping Logistics

Cluster: Tutorials

Invited Session

Chair: Stefan Voss, Universitat Hamburg Institut für Wirtschaftsinformatik, Von-Melle-Park 5, Hamburg, D-20146, Germany, stefan.voss@uni-hamburg.de

1 - Maritime Shipping Logistics

Stefan Voss, Universitat Hamburg Institut für Wirtschaftsinformatik, Von-Melle-Park 5, Hamburg, D-20146, Germany, stefan.voss@uni-hamburg.de

Maritime shipping has marked its undoubted importance in international freight transportation. Related service network design and infrastructure development especially regarding containerization has greatly advanced. This relies on efficient use of information technology and optimization. In this tutorial we classify the main logistics processes in maritime shipping and present a survey of related optimization methods.

■ WB17

17- West 208 B- CC

Interactive Learning

Contributed Session

Chair: Juan Jaramillo, Assistant Professor, Albany State University, 504 College Drive, College of Business, Albany, GA, 31505, United States of America, juan.jaramillo@asurams.edu

1 - Understanding the Relationship between Users' Interaction and Resultant Learning in an Online Learning

Bahareh Azarnoush, ASU, School of Computing, Informatics, and De, Tempe, United States of America, bazarnou@asu.edu, Robert Atkinson, Bianca Bernstein, Jennifer Bekki, George Runger

Online learning is a prevalent part of today's educational system. Tracking individual user activity within an online learning environment (OLE) provides data that can be used to develop a relationship between users' interactions with the content and the resultant learning (e.g., learners who visit certain pages may learn a topic better than those who did not). In this study, we use machine learning to investigate this relationship based on data from an existing OLE.

2 - Interactive Risk Education using Simulation and Other Tools: Experiences from Agriculture

Jay Parsons, Optimal Ag Consulting, Inc., 3226 Ledgestone Ct., Fort Collins, CO, 80528, United States of America, jay.parsons@OptimalAg.com

Turning a passive audience into active learners has proven to be an effective way to achieve educational goals. However, doing so can be a challenge. I will share experiences and insights from using simulations and other tools to create an interactive learning environment for risk management education. These experiences have been gathered from the classroom and from delivering hundreds of workshops across America to agricultural producers and other stakeholders in the agricultural community.

3 - Team Building using Serious Games in Multi User Virtual Environments

Birgul Kutlu Bayraktar, Prof. Dr., Bogazici University, Management Information Systems Department, Hisar Kampus, B214, Istanbul, 34342, Turkey, birgul.kutlu@boun.edu.tr, Nuket Nowlan, Aysun Bozanta, Shervin Shirmohammadi

Multi User Virtual Environments (MUVEs) and serious games may offer an alternative for improving team building. The aim of the project is to investigate the potential of MUVEs and serious games for team development. The serious game "Zoom", exercised for improving team building skills in real life, is adapted using Web.alive 3D platform. The pilot study is carried out with a professional facilitator. The results are promising implying MUVEs can complement face to face played serious games.

4 - Markov Models, Comparative Effectiveness Research, and Neurosurgery

Neil Desnoyers, Assistant Clinical Professor, Drexel University, 3141 Chestnut Street, Philadelphia, PA, 19104, United States of America, ndesnoyers@drexel.edu

With the explosion in healthcare costs, cost effectiveness of patient treatment decisions attracts increased attention. Comparative effectiveness research using Markov models is a primary means of assessing the cost vs. utility of treatment methods. Current and potential future applications in the field of neurosurgery will be discussed.

5 - An Integrative Approach of Teaching Supply Chain and Logistics

Juan Jaramillo, Assistant Professor, Albany State University, 504 College Drive, College of Business, Albany, GA, 31505, United States of America, juan.jaramillo@asurams.edu

The new Bachelor of Science in Logistics and Supply Chain Management (LOGM) at Albany State University focus on eliminating the compartmentalized view of logisticians. Courses are taught using a Learning Integrated Virtual Enterprise (LIVE). LIVE is a virtual Supply Chain in which students role-play as logistics interims. LIVE allows students to see the interrelation among all courses. LIVE is supported by seasoned logisticians and is intensive in professional writing and briefing delivery.

■ WB18

18- West 208 A- CC

Optimization Methodologies: Speed and Efficiency

Contributed Session

Chair: Ioannis Fragkos, University College London, The Downs 22, London, SW20 8HT, United Kingdom, i.fragkos@ucl.ac.uk

1 - Efficient Modeling with CPLEX Studio's Integrated Development Environment and Debugging Support

Vincent Beraudier, OPL Language & IDE Program Manager, IBM, 1681, Route des Dolines, Valbonne, 06560, France, vincent.beraudier@fr.ibm.com, Arnaud Schulz

Good optimization models have to execute fast, but must also scale to adapt to changes in data and constraints. At development time, debugging support is a crucial factor to deliver optimization into IT solutions. This interactive talk will show the debugging capabilities to deal with optimization model testing in IBM ILOG CPLEX Optimization Studio. We will also discuss how the OPL language and Studio ensure quality throughout the entire application life-cycle, from design to deployment.

2 - Improvements on Benders Decomposition Algorithm

Nader Azad, Amirkabir University of Technology, Tehran, Tehran, Iran, n.azad@aut.ac.ir, Georgios Saharidis, Hooman Malekly, Mihalis Golias

Benders decomposition is a well-known decomposition technique for large scale optimization. Heuristic approaches, multi-generation of cuts and approximation methods have been proposed in the literature to accelerate the Benders decomposition algorithm. In this research, we focus on improved multi-cuts generation methods and the use of Evolutionary Algorithms for the solution of Benders master problem.

3 - A New Branch-and-Price Algorithm for Lot Sizing Based on Horizon Decomposition

Ioannis Fragkos, University College London, The Downs 22, London, SW20 8HT, United Kingdom, i.fragkos@ucl.ac.uk, Zeger Degraeve, Bert De Reyck

We present a novel type of Dantzig-Wolfe decomposition where the subproblems are created after a problem reformulation. Our approach allows the user to select among a family of decompositions, thereby controlling the trade-off between bound quality and computational performance. Computational experiments on new classes of hard lot sizing problems show that our approach is superior against branch and cut solvers. We show how this idea is generalized to arbitrary mixed integer programs.

■ WB19

19- West 211 A- CC

Medication and Blood Products

Contributed Session

Chair: Serkan Gunpinar, PhD Candidate, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, sgunpina@mail.usf.edu

1 - Modeling Blood Transfusion Practices in Hospital Environments

Ivo Panhuijzen, Eindhoven University of Technology, Thorbeckelaan 32, Veghel, 5463BM, Netherlands, i.w.f.panhuijzen@Student.tue.nl, Gina Dumkrieger, John Fowler, Pitu Mirchandani

The focus of this research is the creation of a detailed simulation model of the distribution of donor blood within a hospital: from blood and patient entering the hospital up to the actual transfusion. The discrete event model, with agents added where needed, simulates every transfusion separately, given its conditions. This model is created to investigate the effects of policies used in hospitals. Some policy evaluations using the model are presented.

2 - Evaluation of Internal/external Donation Mix on Hospital Blood Supply

Gina Dumkrieger, Arizona State University, 700 W. University Dr. 236, Tempe, AZ, 85281, United States of America, gina.dumkrieger@asu.edu

Many large hospitals receive blood for transfusions from their own, internal, donation centers and from external regional blood centers. This work uses simulation models to evaluate the effect of increasing donations to a hospital's own blood donation center and corresponding decrease in units from a regional blood center. Quantifying the benefits will help donation center administrators decide to what extent to campaignfor increased donations locally and/or what incentives to offer donors.

3 - Vaccination Management: A Cold Supply Chain Design with Mobile Distribution Centers

Osman Kazan, Teaching Assitant, Jindal School of Management, University of Texas at Dallas, 800 West Campbell Road, richardson, TX, 75080, United States of America, oxk031000@utdallas.edu

We recommend setting up a dynamic cold supply chain for vaccination activities. An African country is analyzed for population centers, cold storage units, and existing cold supply chain infrastructure. An accessibility map of the country is generated and an integer programming model is proposed to maximize number of children that can be vaccinated with budget, spoilage time, manpower, and other operational constraints.

4 - Medication-Mix Optimization for Managing Poly-Pharmacy Patients

Manaf Zargoush, ESSEC-McGill, 1810, 2125 Rue Saint Marc, Montreal, H3H 2P1, Canada, m.zargoush@gmail.com

We show how medications of patients, in general, and poly-pharmacy patients, in particular, could be optimized by examining comparative effectiveness of the medications. This is done based on the notions of d-separation in Bayesian networks.

5 - A Multi-period Mixed Integer Programming Model for Inventory Control of Blood Products

Serkan Gunpinar, PhD Candidate, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, sgunpina@mail.usf.edu, Grisselle Centeno

Blood is a perishable product which can be kept on inventory for a limited number of days. Efficient planning of this scarce resource is necessary to improve service and operation quality of hospitals. As blood demand is determined by patient needs, which is very random, we develop a multi-period programming model to efficiently manage blood inventory challenges. As the model indicates non-linear terms, linearization techniques are applied. Numerical experiments will be discussed.

■ WB20

20- West 211 B- CC

Optimal Radiation Treatment II

Contributed Session

Chair: Yuriy Zinchenko, Assistant Professor, University of Calgary, 2500 University Dr NW, MS446, Calgary, AB, T2N 1N4, Canada, yzinchen@ucalgary.ca

1 - A New Approach for Intensity Modulated Radiation Therapy

S.M.H. Manzour, University of Oklahoma, Oak 2900, Norman, OK, United States of America, smh.manzour@ou.edu

Intensity modulated radiation therapy (IMRT) concerns with the collection of beam angels, geometry problem, the calculation of each intensity angel, fluence map problem, and selecting a sequence of configurations of a multileaf, segmentation problem. The objective is to deliver sufficient dose to the cancerous tumor while minimizing the damage to healthy tissue. A new method to tackle the IMRT is developed. Computational results show that the proposed method provides promising results.

2 - Optimal Intensity Modulated Arc Therapy

Robert R. Meyer, Professor Emeritus of Computer Sciences, University of Wisconsin, 1210 W. Dayton, Madison, WI, 53706-1685, United States of America, rrm@cs.wisc.edu, Hao Howard Zhang, Athula Gunawardena

Treatment planning for intensity modulated arc therapy (IMAT) requires the optimization of a large-scale highly-constrained nonlinear optimization problem. We present a novel suite of tools for the solution of this complex problem and compare treatment results with those obtained via commercial treatment planning software.

3 - Moment-based Relaxations of DVH Constraints

Yuriy Zinchenko, Assistant Professor, University of Calgary, 2500 University Dr NW, MS446, Calgary, AB, T2N 1N4, Canada, yzinchen@ucalgary.ca, Pooyan Shirvani Ghomi

Radiation is a primal modality in treating cancers. The treatment outcome directly relates to the radiation dose delivered. Therefore, accurate formulation of the dose distribution requirements, known as DVH, is important. A conventional large-scale MIP-based approach to DVH is difficult to implement in practice. We present a moment-based convex non-linear relaxation of DHV constraints and a method that selects the best sequence of moments, subject to constraint's cardinality.

■ WB21

21- West 212 A- CC

Network Applications I

Sponsor: Optimization/Networks

Sponsored Session

Chair: Douglas Shier, Professor of Mathematical Sciences, Clemson University, Mathematical Sciences Department, Clemson, SC, 29634-0975, United States of America, shierd@clemson.edu

1 - Bilevel Mixed-integer Interdiction Model and Exact Algorithm for Influence Dominating Set Problem

Soheil Hemmati, PhD Student, University of Florida, 406 Weil Hall, Gainesville FL 32603, United States of America, soheilmn@ufl.edu, J. Cole Smith

Social networks, computer networks, etc., are examples of real-world networks in which an attacker may try to exploit the network structure in order to propagate some type of influence such as rumors, infections, etc. over the nodes. We consider a scenario in which we can protect the nodes from being the source of such malicious influence propagation. We suggest a bilevel mixed-integer program, a set of valid inequalities, and an exact algorithm tailored for the problem.

2 - Integrated Network Design and Scheduling Problems with Release Dates

Sarah Nurre, Research Assistant, Rensselaer Polytechnic Institute, 110 8th Street CII 5015, Troy, NY, 12180, United States of America, nurres@rpi.edu, Thomas Sharkey

We consider the problem of allocating resources to process tasks, each with a release date, that correspond to installing components into a network. The main motivating application of this is repairing or reinstalling damaged infrastructure components back into the network after an extreme event. We provide an online optimization heuristic framework for these problems that is motivated by network flow optimality conditions and dispatching rules for scheduling problems.

3 - Averaging Metric Phylogenetic Trees

Scott Provan, Professor, University of North Carolina, Statistics and Operations Research, Chapel Hill, NC, 27599-3260, United States of America, Scott_Provan@UNC.edu, Megan Owen, Ezra Miller

The statistical analysis of tree-like objects has been made significantly more meaningful when viewed in the framework of the phylogenetic tree space developed by Billera, Holmes, and Vogtmann. We discuss properties of this space that enable an effective hybrid steepest descent algorithm to be constructed for finding sample means. We give two applications: reconstructing species trees from gene trees, and comparing the structure of blood vessels in the brain.

4 - A Network Approach to a Geometric Packing Problem

Brad Paynter, Assistant Professor of Mathematics, University of Central Oklahoma, 100 N. University Dr., Box 129, Edmond, OK, 73034, United States of America, bradpaynter@gmail.com, Douglas Shier

We investigate a geometric packing problem (derived from an industrial setting) that involves fitting patterns of regularly spaced disks in the plane without overlap. We derive conditions for achieving the feasible placement of a given set of patterns and discuss related optimization problems. An associated network representation allows one to characterize all feasible solutions and to design heuristic algorithms for this provably difficult problem. Computational experience is also presented.

■ WB22

22- West 212 B- CC

Contingency-Constrained Optimization for the Electric Power Grid

Sponsor: Computing Society

Sponsored Session

Chair: Richard Chen, Senior Member of Technical Staff, Sandia National Laboratories, P.O. Box 969 MS 9155, Livermore, CA, 94551, United States of America, rlchen@sandia.gov

1 - Contingency-risk Aware Power System Design

Ali Pinar, Principal Member of Technical Staff, Sandia National Laboratories, Livermore, CA, 94551, United States of America, apinar@sandia.gov, Neng Fan, Amy Cohn, Richard Chen

We consider optimally designing a power system so that it satisfies the N-k-e criterion, which requires at least 1-e_k fraction of the demand be met even after failures of any k system components. We present a mixed-integer formulation that covers transmission and generation expansion, and propose an algorithm that avoids combinatorial explosion in the number of contingencies. Our studies on modified instances of the IEEE-30 and IEEE-57-Bus systems showed the effectiveness of our methods.

2 - Practically Efficient Algorithms for Contingency-constrained Unit Commitment

Richard Chen, Senior Member of Technical Staff, Sandia National Laboratories, P.O. Box 969 MS 9155, Livermore, CA, 94551, United States of America, rlchen@sandia.gov, Jean-Paul Watson, Neng Fan, Ali Pinar

We consider the problem of optimizing generation unit commitment under load uncertainty while ensuring N-k-\epsilon reliability. We present cutting plane algorithms for solving this problem. But rather than explicitly considering all possible contingencies, we use bilevel separation problems to quickly identify violated contingencies. We also explore a more efficient separation problem that identifies violated cut-set inequalities associated with a simplified transmission model.

3 - Nested Decomposition Strategies for Stochastic Security-constrained N-K Unit Commitment

Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87113, United States of America, jwatson@sandia.gov, Neng Fan, Richard Chen, Ali Pinar

We consider the problem of stochastic security-constrained N-K unit commitment, in which the uncertainty associated with renewables generation output and load are modeled via discrete sampling. In contrast, uncertainty in generator and transmission line availability is addressed directly via N-K security constraints. We introduce a nested decomposition strategy for solving this problem, and present computational results on a number of standard benchmark problems.

4 - N-1-1 Contingency-constrained Optimization Problems in Power Systems

Neng Fan, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87185, United States of America, nnfan@sandia.gov, Richard Chen, Jean-Paul Watson

N-1-1 contingency analysis considers the consecutive loss of two elements in a power system, with intervening time for operator adjustments. In this talk, we use mixed-integer programming approaches for N-1-1 contingency analysis. We test our models and algorithms on several IEEE test systems. Our computational experiments indicate potential for the models to augment comprehensive system operations models, such as unit commitment.

■ WB23

23- West 212 C- CC

Large Scale Spreadsheet Applications in Business

Sponsor: Spreadsheet Productivity Research Interest Group

Sponsored Session

Chair: Ozgur Ozluk, Associate Professor, San Francisco State University, 835 Market Street Suite 589, San Francisco, CA, 94103, United States of America, ozgur@sfsu.edu

1 - Spreadsheet Based Optimization Models for Component Procurement and End-product Assembly

Ramesh Bollapragada, Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu, Robert Chan, Uday Rao, Norman Sadeh

Motivated by the established Trading Agent Competition (TAC-SCM) in Supply Chain Management (http://www.sics.se/tac) environment, the paper (i) presents new adaptive stochastic linear programming models and advanced algorithms implemented in Excel to synchronize the procurement of components for assembly into end-products. (iii) provides strategic insight and guiding principles that help enterprises achieve this subject to competitive demand and supply uncertainty.

2 - Bringing Spreadsheet Reality into the Business Analytics Classroom

Ozgur Ozluk, Associate Professor, San Francisco State University, 835 Market Street Suite 589, San Francisco, CA, 94103, United States of America, ozgur@sfsu.edu

We examine the use of large-scale spreadsheet modeling in different industries, then discuss and present how the learnings can be brought into the classroom where we study business analytics. The talk will have an interactive discussion component.

■ WB24

24- West 213 A- CC

Modeling and Analysis of Healthcare Systems

Cluster: Health Informatics

Invited Session

Chair: Abe Zeid, Northeastern University, MIE Department, Boston, MA, United States of America, zeid@coe.neu.edu

Co-Chair: Sagar Kamarthi, Northeastern University, MIE Department, Boston, MA, United States of America, sagar@coe.neu.edu

1 - Real-time Location Tracking, Modeling and Simulation of Healthcare Systems

Xueping Li, University of Tennessee, 408 East Stadium Hall, Knoxville, TN, 37996, United States of America, Xueping.Li@utk.edu, Joe Wilck, Tom Berg

We explore the use of real-time location services (RTLS) for healthcare systems optimization. A pilot study was conducted in Y-12 Occupational Health Services (OHS) and a management system was developed that monitors the flow of patients and resources in real time, assesses provider workload and predicts what the potential results are by changing schedules or the available resources, and optimizes the scheduling and availability of resources to provide the best throughput for the system.

2 - Optimal Control Policies for Ambulance Diversion Decisions

Esma Gel, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States of America, esma.gel@asu.edu, Adrian Ramirez, Baykal Hafizoglu, John Fowler

We consider optimal ambulance diversion control policies with the objective of minimizing patients' waiting time higher than a recommended safety time threshold. We model the problem using a Markov decision process formulation, and characterize the optimal ambulance diversion decisions. We compare the performance of our policy with simple heuristics using a simulation model, and analyze the value of information in ambulance diversion decisions.

3 - Integrating Heterogeneous Routine Hospital Data to Reduce Unnecessary Variations in Care at Emergency Departments

Sudi Lahiri, University of Warwick, International Manufacturing Centre, Coventry, CV4 7AL, United Kingdom, S.Lahiri@warwick.ac.uk, Darek Ceglarek

Unnecessary variations in care in emergency departments result in patient diverting from care pathways and inefficiencies in healthcare systems including avoidable re-attendances and readmissions. Variation in care is also noted among patients with co-morbidities. This study integrates heterogeneous routine hospital data to comprehensively model patient journeys reducing healthcare system inefficiencies.

4 - Research Frontiers in Healthcare Mass Customization

Sagar Kamarthi, Northeastern University, MIE Department, Boston, MA, United States of America, sagar@coe.neu.edu, Abe Zeid, Tucker Marion

In this research, we investigate operational and strategic issues in healthcare mass customization (HMC) for cost effective and efficient personalization of diagnosis, care and cure. We amalgamate two innovative paradigms personalized medicine and mass customization to build HMC.

■ WB25

25- West 213 B- CC

Healthcare Applications II

Sponsor: Health Applications Society

Sponsored Session

Chair: John Fowler, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287-5906, United States of America, john.fowler@asu.edu

1 - Optimal Hospital-acquired Infection Control Considering Health Care Workers' Strategic Behavior

Wenlin Chen, PhD Candidate, Australian School of Business, University of New South Wales, 215A Anzac Parade Kensington, Sydney, 2052, Australia, wenlin.chen@Student.unsw.edu.au, Chung-Li Tseng, Sunny Shu-Jung Yang

Although hospitals require health care workers (HCWs) to wash hands in every hand hygiene opportunity, literature suggests that HCWs decide hand hygiene adherence strategically. We develop a game-theoretic model that integrates infection transmission dynamics and HCWs' strategic hand hygiene behavior. The model sheds light on hospitals' optimal infection control strategy that minimizes the prevalence of antibiotic-resistant bacteria and HCWs opportunistic behavior.

2 - Who Benefits when Prescription Drug Manufacturers Offer Co-pay Coupons?

Greg King, PhD Candidate, University of Michigan, Department of Industrial and Operations, Ann Arbor, MI, United States of America, gjking@umich.edu, Xiuli Chao, Izak Duenyas

Prescription drugs have played a meaningful role in the rising cost of health care in the United States. In an effort to manage cost, insurance companies induce patients to choose less expensive medications by making them pay larger copayments for more expensive drugs. However, drug manufacturers have defended market positions in recent years by offering co-pay coupons. The goal of this paper is to understand the impact of co-pay coupons in a competitive environment with strategic patients.

3 - Improving the Efficiency of Catheterization Laboratories using Simulation

John Fowler, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287-5906, United States of America, john.fowler@asu.edu, Mohan Gopalakrishnan, Srimathy Mohan, Antonios Printezis, Qing Li

This paper uses a simulation-based framework for analyzing the factors that affect utilization of catheterization labs with different types of patients. The study compares alternative policies such as time allotted to each case, positioning of time buffers to absorb delays, etc on operational efficiency using data from an actual hospital. The facility under study implemented our recommendations and realized a 21% increase in utilization as well as a 41% decrease in overtime.

■ HAS Poster Session

West Building Foyer

Cluster: HAS Poster

Invited Session

Chair: Steven Shechter, Sauder School of Business at the University of British Columbia, Vancouver BC, Canada, steven.shechter@sauder.ubc.ca

1 - An IP-based Handoff-sensitive Shift Design Approach for Scheduling Critical Care Trainees

Pooyan Kazemian, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, pooyan@umich.edu, Thomas Rohleder, Jonathan Helm, Mark Van Oyen, Yue Dong

Recent ACGME duty-hour limits were intended to reduce fatigue-related medical errors. However, the resulting shorter shifts are associated with more frequent handoffs that correlate with adverse events. We employ optimization (integer programming) to develop on-call schedules for ICU residents/fellows that comply with ACGME regulations, provide 24/7 ICU coverage, and satisfy livability constraints with as few patient handoffs as possible. Implementation in a hospital setting is discussed.

2 - Analyzing Factors Associated with Women's Attitudes and Behaviors toward Mammography

Mahboubeh Madadi, University of Arkansas, 4207 Bell Engineering Center 1 Universit, Fayetteville, AR, 72701, United States of America, mmadadi@email.uark.edu, Shengfan Zhang, Karen H. Kim Yeary, Louise Henderson

Women's compliance with breast cancer mammography screening guidelines remained low in recent years. This study identifies factors associated with women's adherence to mammography using Health Information National Trends Survey (HINTS) data. We use design-based and model-based logistic regression as well as artificial neural network to characterize the social-demographic, health and behavioral factors that are related to women's attitudes toward mammogram screening.

3 - Antiviral Resistance and Mitigation of Pandemic Influenza

Sandro Paz, Ph.D. Candidate, Associate Professor, University of South Florida, 18125 Birdwater Dr, Tampa, FL, 33647, United States of America, spaz@mail.usf.edu, Alex Savachkin

We are building a large-scale simulation optimization framework for antiviral based mitigation of pandemic influenza. The model considers an oseltamivir-sensitive strain and a resistant strain with low/high fitness cost. Mitigation strategies include treatment of symptomatic cases and chemoprophylaxis of pre- and post-exposure cases.

4 - Developing a Quantitative Assessment Framework for Reliability of Surgical Teams

Amanda Baty, Texas Tech University, 3424 Frankford Ave., Apt. 8B, Lubbock, TX, 79407, United States of America, amanda.baty@ttu.edu, Timothy Matis

The first phase in the development of a quantitative assessment framework for reliability in surgical teams based on communication will be outlined. A method for how the communication patterns can be visualized through recurrence plots and subsequently quantified through recurrence quantification analysis will be presented. Recurrence plots are an N-by-N array of dots which provides a 2-d representation of data and allows for instant interpretation of whether the system is periodic or chaotic.

5 - Drug Discovery Harnessing Molecular Topology with Optimization Techniques

Medha Dhurandhar, Director & HoD, Centre for Dev. of Advanced Computing, Pune University Campus, Ganeshkhind Rd, Pune, 411007, India, mdhurandhar@gmail.com

Topological Indices encode molecular structure as math. descriptors enabling quantitative matching to physicochemical properties/biological activities .Top Models with TIs (multivalued graph invariants) & Classification techniques applied to naturally occuring molecules - New Drug Synthesized molecules - Drug Design GA applied to construct the optimal set of TIs avoiding overfitting, providing flexibility to unearth non-obvious patterns in known/unknown molecules.

6 - Electronic Medical Record (EMR) and Physician Career Satisfaction

Fei Li, University of Southern California, Los Angeles, CA, 90089, United States of America, feil@usc.edu

This study uses survey to assess the association of physician career satisfaction and potentially significant factors of EMR system and implementation process. Based on Technology of Acceptance and Use of Technology (UTAUT) model and successful cases studies, the factors are developed in four constructs: perceived usefulness of EMR, perceived ease of use, social influence and facilitating conditions during implementation process. Factor analysis and logistic regression are performed.

7 - Emergency Response Models with Relocation and Dispatching Decisions

Ibrahim Capar, University of Alabama, Tuscaloosa, Tuscaloosa, AL, 35487, United States of America, icapar@cba.ua.edu, Burcu Keskin, Sharif Melouk

EMS mangers need to solve two common problems regarding emergency vehicles, dispatching and relocation. We propose a model that considers dispatching more than one emergency vehicle to an incident location and evaluating total travel time, last responder arrival time, and first responder arrival time. We also consider vehicle relocation and measure the impact of such decisions. Finally, experimentation is performed on several scenarios, and managerial insights are gleaned.

8 - Hospital Safety and HIT: A Cross-Sectional Study of US Acute-Care Hospitals

M. Eric Johnson, Professor, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States of America, m.eric.johnson@dartmouth.edu, Ajit Appari, Denise Anthony

Patient safety is a major hospital challenge drawing renewed attention as a national priority. Using a sample of over 3000 U.S. hospitals, we examine whether hospitals using surgical IT and EHR capable of meeting Stage-1 meaningful use objectives are providing safer care.

9 - Imaging Room and Beyond: The Underlying Economics Behind Physicians' Test-Ordering Behavior"

Tinglong Dai, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, dai@cmu.edu, Sridhar Tayur, Mustafa Akan

The Congressional Budget Office estimated that $700 billion per year, or 5 percent of the nation's GDP, is spent on unnecessary tests and procedures that do not improve health outcomes. In this study, we investigate the underlying operational and economic drives behind physicians' test-ordering behavior in an outpatient setting, motivated by a collaborative study with a major ophthalmology clinic. Several service settings are examined, leading to insights that depart from conventional wisdom.

10 - Innovation Failure: Sources and Conscequences

Ujjal Mukherjee, Research Assistant, University of Minnesota, 1261 Gibbs Ave Apt G, Saint Paul, MN, 55108-1159, United States of America, mukh0067@umn.edu

We look at sources of innovation failure. We address the key question: Is there a systematic pattern related to innovation failure, or is it purely stochastic? We analyze data from medical device recalls. We posit that: Majority of the failures is due to systematic decision biases which result in over-sight of critical components of the innovation process. We look at innovation failure from product and process point of view.

11 - Performance Evaluation of a Collaborative Framework for Medical Services

John Jung-Woon Yoo, Assistant Professor, Bradley University, 1501 W. Bradley Ave., Peoria, IL, 61625, United States of America, jyoo@bradley.edu, Krishnaveni Gnanasekaran

In our earlier work, a cyberinfrastructure-based collaboration framework for medical services has been proposed. In this paper, the performance of the framework is evaluated through a simulation study. The simulation results show that the proposed collaboration framework significantly reduces the lead time of patients' treatment time and increases the utilization of the resources of healthcare providers.

12 - Radiation Dose Optimization for Critical Organs in Interventional Radiology

Yasaman Khodadadegan, PhD Candidate, Arizona State University, 699 S. Mill Ave., Brickyard Engineering (BYENG) 553, Tempe, AZ, 85281, United States of America, ykhodada@asu.edu, Muhong Zhang, William Pavlicek

A large number of examinations are performed on Interventional Radiology equipments everyday. An integrated method is required to determine patient centric configurations for each procedure to minimize the absorbed dose in the critical organs and achieve reasonable image quality. This study presents a MIP formulation which determines the initial geometry and required energy for a procedure. Added inequalities to the branch and cut algorithm improve the computation time and solution quality.

■ WB26

26- North 221 A- CC

Capacity Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Hyun-Soo Ahn, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, hsahn@umich.edu

1 - Investing in Supplier Capacity: Cost-sharing Mechanisms and Experimental Tests

Shanshan Hu, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, hush@indiana.edu, Zhixi Wan, Qing Ye, Wei Chi

Taking a buyer's perspective, we investigate if simple cost-sharing mechanisms can induce capacity investment from competing suppliers. We show that linear-sharing mechanism can achieve this goal but reduces the buyer's profit, and this short-coming can be overcome by a modified target-sharing mechanism. Experiment studies confirm our theoretical predictions.

2 - Perfusion Production Planning

Dan Bu, University of California, Berkeley, IEOR Department, Berkeley, CA, 94720, United States of America, julia200907@gmail.com, Phil Kaminsky

Motivated by a specific type of semi-batch biotech manufacturing, perfusion, we consider production planning and control for processes where manufacturing has to be periodically restarted and yield is random, but is known soon after processing begins. In this setting, firms must decide when to start and when to restart production of multiple products to minimize costs and to meet customer service requirements.

3 - Capacity Investment with Demand Forecast for a Finite-life-cycle Product

Anyan Qi, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, anyqi@umich.edu, Amitabh Sinha, Hyun-Soo Ahn

For a new product with a finite life cycle, how should a firm invest in her capacity when the firm does not have complete information about the demand process? We develop a data-driven approach where the firm dynamically updates her belief about demand and makes capacity investment decision accordingly. We show the firm should follow a U/S/D (upgrading/staying the same/downgrading) policy in each period, and we evaluate performance of the approach relative to a simple hypothesis testing.

4 - Stability and Endogenous Formation of Inventory Transshipment Networks

Xin Fang, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, xfang@andrew.cmu.edu, Soo-Haeng Cho

This paper studies a cooperative game of inventory transshipment among multiple firms. In this game, firms first make their inventory decisions independently under uncertain demands, and then decide collectively how to transship excess inventories to satisfy unmet demands. Instead of coalitions that are used in all previous studies, we use networks of firms as the primitive, which offer a richer representation of relationships among firms by taking coalitions as special cases.

■ WB27

27- North 221 B- CC

Field Tests, Experiments and Empirical Work in OM

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Felipe Caro, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu

1 - Illusionary Trend Detection in Time Series Forecasting

Mirko Kremer, Pennsylvania State University, State College, PA, United States of America, muk22@smeal.psu.edu, Enno Siemsen, Brent Moritz

Behavioral experiments show that human forecasters are quick to detect trends in a time-series dataset where none exist. We examine how this behavior depends on underlying structural parameters of the time series, and the resulting performance implications.

2 - Empirical Analysis of Inventory Display Strategies in Retail

Santiago Gallino, The Wharton School, 3720 Walnut St., Philadelphia, 19104, United States of America, sgallino@wharton.upenn.edu, Antonio Moreno-Garcia, Marshall Fisher

When making decisions about inventory management, managers must determine how inventory affects demand. In this paper, we are interested in studying how inventories affect demand beyond the availability effect. We propose a series of field experiments at retail locations to estimate the effect of inventory on demand. Our objective is to identify groups of items for which the inventory displayed has an effect on demand.

3 - Pricing and Inventory Coordination Field Test at Zara

Felipe Caro, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu

One of Zara's biggest challenges in preparation for the clearance season is determining how to distribute 11,000 different fashion designs to over 1,600 stores worldwide. We describe the field test of a model to distribute merchandise to stores with the highest sales potential in order to maximize revenues during the clearance period.

■ WB28

28- North 221 C- CC

Customer Behavior and Pricing

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yanchong Karen Zheng, Massachusetts Institute of Technology, Sloan School of Management, 100 Main Street, Cambridge, MA, United States of America, yanchong@mit.edu

1 - Price Matching under Preannounced Discounts in the Presence of Strategic Consumers

Navaporn Surasvadi, PhD Candidate, New York University, 44 West Fourth St., New York, NY, 10012, United States of America, nsurasva@stern.nyu.edu, Gustavo Vulcano

We study a RM problem in which a seller operates an internal price match guarantee policy. Upon arrival, each consumer must decide either to buy at the full price or to buy later at a discount price and run a supply risk. If there is a markdown in the end, the seller will refund a fraction of the price difference to consumers who paid the full price. We analyze the equilibrium behavior of the consumers and the optimization problem of the seller, and illustrate with some numerical experiments.

2 - Understanding Preferences for Suboptimal Contracts: The Moral Hazard Effect

Wedad Elmaghraby, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States of America, welmaghr@rhsmith.umd.edu, Anna Devlin

We examine how the moral hazard problem affects supplier preferences for economically inferior contracts. Our experiments incorporate a two period selling season during which retailers may sell items on sale. While interdependence between parties and perceptions of low retailer effort can decrease preferences for coordinating contracts, a sale period with price weakly decreasing in the amount of leftover inventory can reverse this effect.

3 - Consumer Learning and Queues

Senthil Veeraraghavan, Associate Professor, The Wharton School, 3730 Walnut Street Suite 550, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu

We analyze how pricing decision of a service provider and social welfare is affected by consumer behavior, when consumers have limited knowledge of a firm's service policy. If the consumers use their past experiences to learn about firm's service rate, the firm may not gain revenues, even if consumer beliefs and actions are consistent with the true service rate.

■ WB29

29- North 222 A- CC

Emergency Services

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14850, United States of America, sgh9@cornell.edu

1 - A Mixed Integer Programming Model for Locating and Dispatching Ambulances

Laura McLay, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave., Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Sardar Ansari, Maria Mayorga

In this presentation, we propose a novel mixed integer programming (MIP) model for identifying how to locate and dispatch ambulances through district design. The model maximizes the coverage level, i.e., the fraction of high-priority calls that can be responded to within nine minutes. The model locates ambulances at stations, assigns each call location to open ambulance stations according to a priority list, and balances the workload across the ambulances.

2 - A Capacity Model for Emergency Call Centers

Rob van der Mei, Cluster Leader, Centrum Wiskunde & Informatica (CWI), Science Park 123, Amsterdam, Netherlands, R.D.van.der.Mei@cwi.nl, John Puts, Martin van Buuren, Geert-Jan Kommer

In life-threatening emergency situations, the ability of ambulance service providers to arrive at the emergency scene within a few minutes may make the difference between survival or death. We study a capacity model for Emergency Medical Services call centers, including different types of callers and for each type the different steps involved in handling the calls from triage until hospitalization. The model is validated by real-life data. The results show that the model is highly accurate.

3 - Improving EMS Patient Survivability via Simulation-Optimization

Cem Saydam, Professor, University of North Carolina Charlotte, 9201 Univ City Blvd, Charlotte, NC, 28223, United States of America, saydam@uncc.edu, Hari Rajagopalan, Elizabeth Sharer, Muhammad Zaffar

Location models for emergency medical systems (EMS) have been dominated by coverage models. So long as an ambulance is within coverage range it is considered covered. Recent papers have shown the problem with this approach and have tried to incorporate survivability which is a function of how close the ambulance is to the demand location. In this paper, using simulation optimization to locate ambulances, we are able to show that survivability of EMS patients can be improved.

4 - Modeling EMS Yellow Alert Periods as Partial Busy Periods

Amir Rastpour, University of Alberta, School of Business, Edmonton, AB, T6G2R6, Canada, rastpour@ualberta.ca, Bora Kolfal, Armann Ingolfsson

A "k-partial busy period" in a multi-server system, where k or more servers busy, corresponds to a "yellow alert" period for an ambulance system, where the number of free ambulances drops below a threshold. We compute expected values and Laplace transforms of partial busy period durations in a loss system. We show that the expected durations are insensitive to the service time distribution and that if service times are GH-distributed then the partial busy periods are GH-distributed.

■ WB30

30- North 222 B- CC

Heuristics for Facility Location

Contributed Session

Chair: Dincer Konur, University of Memphis, 3571 Midland Ave., Apt. 6, Memphis, TN, 38111, United States of America, dkonur@memphis.edu

1 - A Genetic Algorithm Metaheuristic for Bakery Location and Routing Problem

Baris Kiremitci, PhD, Istanbul University, Ulastirma ve Lojistik Yuksekokulu, Avcilar, Istanbul, 34320, Turkey, baris@istanbul.edu.tr, Serap Kiremitci, Timur Keskinturk, Mehmet B. Yildirim

In this paper, we proposed a genetic algorithm approach for location and routing problem of a bakery in Istanbul, Turkey. A new bakery is planned to open due to an increase in business volume. Proposed genetic algorithm approach is used to determine the best of three location alternatives which minimizes the total distribution costs and satisfies routing plan requirements.

2 - Medical Facility Network Design: System-Optimal and User-Choice Models

Yue Zhang, Assistant Professor, University of Toledo, 2801 W. Bancroft Street, Toledo, OH, 43606, United States of America, yue.zhang@utoledo.edu

This talk presents the network design of medical facilities to maximize the overall utility of clients. Facility locations and capacities are the main determinants. We consider three alternative models: system-optimal, optimal-choice, and probabilistic-choice models. To solve the problems efficiently, we propose a common solution methodology along with the location-allocation framework. Based on a real life example, a number of interesting insights are discussed.

3 - The Benefits of Demand Assignment in Location Models

Yuan Zhou, National University of Singapore, 05,21, BLK E1A, NUS, Singapore, Singapore, g0900466@nus.edu.sg, Boray Huang, Hui-Chih Hung

Most of the existing location models do not assign each demand node to a specific station, and then each node accordingly, can be served by any vehicles in the neighborhood. As such, it is difficult to obtain the workload for each station or vehicle. In this paper, we introduce assignment into the traditional location models, and attempt to explore the advantages and disadvantages of such demand assignment. The benefits of demand assignment are also demonstrated by numerical studies.

4 - Solving the Hub Location and Routing Problem by Decomposition

Armin Luer-Villagra, Pontificia Universidad Católica de Chile, Vicuña Mackenna 4860. Macul., Santiago, Chile, arminluer@gmail.com, Vladimir Marianov

We formulate a hub location and routing problem with single assignment. We used a variation of Benders Decomposition to optimally solve medium size instances. Based on it, we implemented an hybrid metaheuristic with decomposition for larger instances. Computational results show that the proposed methods are an improvement over standard methods.

5 - Company-Owned Retailer Location Decisions for Competitive Retailers

Dincer Konur, University of Memphis, 3571 Midland Ave., Apt. 6, Memphis, TN, 38111, United States of America, dkonur@memphis.edu

In this paper, we analyze a store location problem faced by a manufacturer/supplier, who markets a product through a set of competitive retailers. A game theoretical approach is used to solve the retailers' supply quantity decisions as well as the manufacturer's location choice for retailer stores. We analyze characteristics of the game and utilize these characteristics in developing eefficient heuristic methods for the manufacturer's retailer store location problem.

■ WB31

31- North 222 C- CC

Staffing and Routing in Call Centers

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Amy Ward, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089-0809, United States of America, amyward@marshall.usc.edu

1 - Staffing and Admission Control in an M/M/N+M Queue with an Uncertain Arrival Rate

Yasar Levent Kocaga, Assistant Professor of Operations Management, Syms School of Business, Yeshiva University, New York, United States of America, kocaga@yu.edu, Mor Armony, Amy Ward

We study staffing and admission control for a system with abandonment and with an uncertain arrival rate. The upfront staffing decision is made when the arrival rate is unknown and the admission control decision is made after the arrival rate has been realized once. We propose a policy that uses a square-root staffing rule and admits customers in accordance with a threshold rule and show that our policy is asymptotically optimal.

2 - A Two-stage Call Center Staffing Problem with Bayesian Updating

John Hasenbein, Associate Professor, University of Texas at Austin, 204 E. Dean Keeton St. Stop C2200, Austin, TX, 78712, United States of America, jhas@mail.utexas.edu, Jing Zan, David Morton, Vijay Mehrotra

We consider staffing agents in which an initial forecast of the call volume is given at the beginning of the day. After an initial observation period, the manager has the ability to update the staffing level based on a revised forecast. The manager operates under QoS constraints which can be very general. The resulting problem is formulated as a two-stage stochastic program. When utilization is the metric, the resulting solution can be written in a closed form analogous to a newsvendor solution.

3 - Routing to Manage Resolution and Waiting Time in Call Centers with Heterogeneous Servers

Vijay Mehrotra, University of San Francisco, School of Management, 2130 Fulton Street, San Francisco, CA, United States of America, vmehrotra@usfca.edu, Geoff Ryder, Kevin Ross, Yong-Pin Zhou

We define agent peformance by both the average call handling time (AHT) and the call resolution probability (RP) and explore strategies for determining which calls should be handled by which agents, where these assignments are based on the specific attributes of the agents and/or the current state of the system. We test several routing strategies to characterize overall performance in terms of customer waiting time and overall resolution rate.

4 - The Speed Quality Dilemma in Large Call Centers with Heterogeneous Servers

Amy Ward, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089-0809, United States of America, amyward@marshall.usc.edu, Dongyuan Zhan

We consider a call center with heterogeneous agents differentiated by their service speed and quality, where quality is measured by the percentage of callers who call back after service. There is a natural trade-off between minimizing wait time and minimizing call-backs when routing calls. We propose a threshold routing policy based on the diffusion control problem that arises in the Halfin-Whitt many-server limit regime. Simulation results show our proposed policy outperforms other policies.

■ WB32

32- North 223- CC

Advanced Information Economics with Applications to Operations

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Ying-Ju Chen, UC Berkeley, Berkeley, United States of America, chen@ieor.berkeley.edu

1 - Competitive Marketing Strategies over Social Networks

Kostas Bimpikis, Stanford University, Stanford, CA, United States of America, kostasb@stanford.edu, Asuman Ozdaglar, Ercan Yildiz

Recent advances in information technology have allowed firms to gather vast amounts of data regarding consumers' preferences and the structure and intensity of their social interactions. This paper examines a model of competition between firms, which can target their marketing budgets to individuals embedded in a social network. We provide a sharp characterization of the optimal targeted marketing strategies and highlight their dependence on the underlying social network structure.

2 - Optimal Long-Term Supply Contracts with Asymmetric Demand and Inventory Information

Ilan Lobel, New York University, Stern Business, 44 W 4th St., New York, NY, United States of America, ilobel@stern.nyu.edu, Wenqiang Xiao

We study the problem of finding optimal dynamic supply contracts when faced with a retailer with private demand and inventory information. We show that the optimal contract is very simple one: retailers pick a wholesale price, pay a fee and the manufacturer sticks to this wholesale price.

3 - Dynamics of Social Learning with Consumer Reviews

Bar Ifrach, Columbia Business School, 3022 Broadway, Uris Hall, 4 West St., New York, NY, 10027, United States of America, BIfrach14@gsb.columbia.edu, Costis Maglaras, Marco Scarsini

A monopolist offers a product to a market of consumers with heterogeneous quality preferences. Although initially uninformed about the product quality, they learn by observing past purchase decisions and reviews of other consumers. We characterize the dynamics of this learning process for markets with high demand intensity. This analysis can be put to use to study various operational and marketing decisions (for example pricing) when consumers engage in social learning.

4 - Signaling in Social Networks

Ying-Ju Chen, UC Berkeley, Berkeley, United States of America, chen@ieor.berkeley.edu, Junjie Zhou

We study the optimal selling scheme with the positive externality among the consumers, the seller's price discrimination power, and the inherent information transmissions among them. We identify the consumers' intrinsic signaling incentives and the positive feedback effects. The optimal hierarchy turns out to be a chain structure in which the seller sells the products to the consumers one by one, and the revenue-maximizing pricing features the cream skimming strategy.

■ WB33

33- North 224 A- CC

Inventory Management in Retail

Contributed Session

Chair: Sungyong Choi, Assistant Professor, Yonsei University, 1 Yonseidae-gil, Wonju, 220-710, Korea, Republic of, sungyongchoi@gmail.com

1 - Data-driven Order Policies with Censored Demand and Substitution in Retailing

Anna-Lena Beutel, Technische Universitat München, TUM School of Management, Arcisstrafle 21, Munich, 80333, Germany, anna.beutel@tum.de, Stefan Minner

We formulate a data-driven inventory model that takes prevalent retail characteristics into account. The model integrates forecasting and inventory optimization by considering the effects of external factors on demand, unobservable lost sales and substitution behavior. Our numerical study and data from a large European retail chain show that the model improves existing approaches in terms of inventory and service level, especially for highly censored and price-dependent demand.

2 - Retailer Transshipment versus Central Depot Allocation for Supply Network Design

Claudia Rosales, Michigan State University, 350 North Business Complex, East Lansing, MI, 48824, United States of America, Rosales@bus.msu.edu, David F. Rogers, Uday Rao

A supply chain structure with shipments from an external warehouse directly to retailers is considered. Two enhancement options are compared: costly transshipment among retailers vs. cost-free allocation from a central depot. We employ a simulation-optimization approach to compare the performance of both structures for varying coefficient of variation, demand correlations, lead times; and transshipment, holding, and penalty costs. In general the transshipment approach is found to perform better.

3 - A Risk-averse Inventory Model with Fluctuating Purchasing Costs

Sungyong Choi, Assistant Professor, Yonsei University, 1 Yonseidae-gil, Wonju, 220-710, Korea, Republic of, sungyongchoi@gmail.com

We study a dynamic risk-averse inventory model. We also assume Markovian behavior of purchasing costs reflecting a global supply chain. We provide our problem formulations with finite and infinite MDP problems. For the finite time models, we prove base-stock optimal policies and conduct comparative static analysis for model parameters. For the infinite time models, we show stationary base-stock optimal policies exist and the monotone properties proven for the finite time models are inherited.

■ WB34

34- North 224 B- CC

Transportation and Shipping II

Contributed Session

Chair: Michael Haughton, Professor, Wilfrid Laurier University, 75 University Avenue West, Waterloo, ON, N2L 3C5, Canada, mhaughton@wlu.ca

1 - The Inventory Routing Problem with Third Party Logistics

Hadi Sadrsadat, Research Assistant, University of Maryland, 1179 Glenn Martin Hall, College Park, MD, 20742, United States of America, hadisadr@umd.edu, Ali Haghani

In this research, the inventory control and transportation of one bottling company working jointly with Coca-Cola Company is studied. The company may not have enough vehicles for its deliveries. In this case, this model is able to consider different alternatives such as sending more products to retailers in advance, renting vehicles to increase fleet size, and contracting with third party companies to outsource shipping or warehousing. This model maximizes the profit of the company.

2 - Optimization Transport and Routing of Vehicles in the Metropolitan Area of Monterrey NL

Jose Velarde, PhD Student Engineering Industrial and Manufacturing COMIMSA, San Nicolas de los Garza Nuevo Leon, Monterrey, 66460, Mexico, jmvelarde79@gmail.com

In this article we address the problem of routing a fleet of different vehicles from several depots to customers with known demands and time windows. It is assumed that a vehicle has to return back to the central depot after visiting a customer, such that a transportation network has a star-case structure. The objective is to minimize the cost of vehicles to satisfy the demand in time. The mathematical model is presented together with a numerical study.

3 - Event-driven Dynamic Vehicle Dispatching for Express Industry

Dingding Lin, IBM Research-China, Building 19, 8 Dongbeiwang WestRoad, Beijing, China, ddlin@cn.ibm.com, Li Zhang, Yongqing Xue, Hongwei Ding

The express market is growing rapidly in China. However, due to the lack of proactive planning capability to handle fluctuating demands, delivery delay is one of the major problems for most Chinese express companies. Dynamic vehicle dispatching is critical to stage vehicles at the right places and time in response to the demand fluctuation and exceptional events. In this paper, a system architecture of dynamic vehicle dispatching driven by special events is proposed for express industry.

4 - Solving Large-scale Integrated Location-routing Problems for Urban Logistics Applications

Matthias Winkenbach, WHU-Otto Beisheim School of Management, Burgplatz 2, Vallendar, 56179, Germany, matthias.winkenbach@whu.edu, Alain Roset, Paul R. Kleindorfer, Stefan Spinler

We present a large scale static, deterministic mixed inter linear programming model solving integrated location-routing problems in the context of urban logistics services (ULS). We aim at determining a cost optimal infrastructure and fleet design for an urban consolidation and transportation network. The model is meant to quantitatively evaluate potential strategic moves of postal operators like French La Poste into the domain of ULS, harvesting potential synergies with their postal operations.

5 - Queue Control at Border Checkpoints: Supply Chain Velocity and Infrastructure Effects

Michael Haughton, Professor, Wilfrid Laurier University, 75 University Avenue West, Waterloo, ON, N2L 3C5, Canada, mhaughton@wlu.ca, Sapna Isotupa

We examine the queue control tactic of reducing the amplitude of hour-to-hour arrival rate of commercial traffic at Canada-US border checkpoints. We show that this tactic can reduce (i) unnecessary investment in expanding border infrastructure and (ii) delays in trans-border supply chains. As well, we discuss issues concerning what would be expected of trucking companies in order for the tactic to be successfully implemented.

■ WB35

35- North 225 A- CC

Behavioral Model Based Revenue Management

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Roger Gung Sr., Manager of Business Analytics and Optimization, University of Phoenix, 4025 S Riverpoint Pkwy, Phoenix, AZ, 85251, United States of America, roger.gung@phoenix.edu

1 - Revenue Optimization in Higher Education Industry

Roger Gung, Sr. Manager of Business Analytics and Optimization, University of Phoenix, 4025 S Riverpoint Pkwy, Phoenix, AZ, 85251, United States of America, roger.gung@phoenix.edu, Tao Kang

Scholarship program in higher education industry is considered as promotions in marketing, so as to boost sales. In this research, we developed a non-linear optimization approach, in conjunction with students' academic behavioral models, to determine the optimal scholarship program crtiera that intends to maximize the revenue while offering grants to hi-performing financially needy students.

2 - New Degree Enrollment Forecasting in Higher Education Industry

Tao Kang, Operations Research Scientist, University of Phoenix, 4025 S Riverpoint Pkwy, CF-K301, Phoenix, AZ, 85040, United States of America, tao.kang@phoenix.edu, Roger Gung

Revenue forecast in higher education industry is based on the new degree enrollment forecast. In this research, we developed Cox survival models to forecast the conversion rates of marketing leads to new degree enrollments.

■ WB36

36- North 225 B- CC

Supply Chain, Manufacturing and Stochastic Program

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Lila Rasekh, Disney, Lila.rasekh@gmail.com

1 - Stochastic Model for Pricing Optimization

Yihua Li, Disney, Orlando, FL, United States of America, Yihua.Li@disney.com, Bruce Wang, Luz A. Caudillo-Fuentesa

Given Price-Demand elasticity forecasting, optimally determine price to maximize total revenue plays an key role for most public service providers, such as: hotels, car rental, retails, etc. By the nature of the problems, stochastic optimization model will counter all uncertainties. Traditional SLP with dynamic programming (DP) is not solvable for most realistic networks because of the large dimensionality of the state space (e.g., typical numbers for even a modest-sized hotel with hundreds of thousands products and for each product DP will go along each of stages = 180-500, each unit of capacities = 500-3000, each of time slots = 500 – 10000, leading to at least 10100 states). Moreover, DP cannot directly deal with constraints, such as upgradings(UP) and overbookings (OB). We will develop a stochastic model which is solvable together with RU and GB. We accomplish solving it in real time by suggesting a heuristic that generates a good initial feasible solution.

2 - Stochastic Modeling of the Traveling Salesman Problem
Jay Brown, Kent State University, College of Business Administration, Kent, OH, 44242, United States of America, jrbrown@kent.edu, Alfred Guiffrida

The traveling salesman problem (TSP) is approached from a stochastic perspective and modeled from results gained from simulations of randomly generated TSPs based on factors such as region size and shape, number of customers, and depot location. Stochastic modeling improves the quality of information available for planning and offers the ability to gauge the probabilistic likelihood of costs associated with optimal tours.

3 - Integrating Advance Demand Information in Supply Chain Contracts
Deng Ge, Senior Consultant Operating Strategy, Gap Inc., San Francisco, CA, United States of America, Ananth Krishnamurthy

Advance demand information (ADI) obtained from customers could be extremely valuable in optimizing production and inventory decisions in supply chains. This research investigates how this information can be integrated into an options-futures contract to determine optimal production and inventory decisions in a supply chain. Using optimization models, we investigate the interaction between the quality of the ADI and decisions to exercise the options, and the associate profits. Our results could be useful in utilizing ADI effectively and designing optimal contract structures that promote sharing of ADI.

■ WB37

37- North 226 A- CC

Inventory or Capacity-based Dynamic Pricing

Contributed Session

Chair: Ruxian Wang, Research Scientist, Hewlett-Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, ruxian.wang@hp.com

1 - Inventory Based Pricing for Perishable Products: To Discount or Not
Arvind Sainathan, Assistant Professor, Nanyang Business School, Nanyang Technological University, S3-B2A-03, 50 Nanyang Avenue, Singapore, Singapore, Asainathan@ntu.edu.sg, Geoffrey Chua, Reza Mokhlesi

Should a retailer be selling products at a constant, "everyday low" price or should she be offering occasional discounts? We analyze this question in the context of pricing and inventory optimization of perishable products. We find two key results. First, when both inventory and discounting decisions are optimized, discounting policy exhibits a threshold structure. Second, partially discounting the price of some units never benefits the retailer; she either discounts all or none of them.

2 - Coordinating Inventory Control and Pricing Strategies for Perishable Products
Zhan Pang, Lancaster University Management School, Department of Management Science, Lancaster, LA1 4YX, United Kingdom, z.pang@lancaster.ac.uk, Limeng Pan, Xin Chen

We analyze a coordinated pricing and inventory control problem for a perishable product with a fixed lifetime. Employing the concept of L-natural concavity, we characterize the structure of the optimal policies. Motivated by the structural results, we develop an effective heuristic policy. We further show that our approach can be extended to handle serial inventory systems and assembly systems, models with random life-time and inventory rationing models with multiple demand classes.

3 - Competition in Service Supply Chains with Risk-averse Retailer
Hongyan Li, Northeastern University, Post Box 329#, Northeastern University, Shenyang, 110819, China, hongyanli2009@gmail.com

Price and service quality are two key competition factors among service companies. This study addresses the service supply chain competition problem when the retailer faces stochastic demand rates and is risk aversion. The competition situations under the centralized, decentralized SCs are analyzed respectively. The utility-based competition models are formulated, and the equilibrium results are presented. At last, the study is extended to include supplier's capacity competition.

4 - Dynamic Pricing and Inventory Strategies with Demand Learning
Paulo Rocha e Oliveira, IESE Business School, Av Pearson, 21, Barcelona, Spain, paulo@iese.edu, Rene Caldentey

We consider a multi-period problem where a retailer uses demand estimates to select the optimal level of inventory and price. Demand is stochastic and price-sensitive; the retailer learns customer preferences through interactions. We model the learning process and develop a methodology to update knowledge. Accumulated knowledge is used to market more profitably. Objective is to maximize expected profit over the planning horizon balancing short-term profit maximization and long-term learning.

5 - Capacitated Assortment and Price Optimization under the Multinomial Logit Model
Ruxian Wang, Research Scientist, Hewlett-Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, ruxian.wang@hp.com

We consider a capacitated assortment and price optimization problem, where customers' purchase behavior follows the multinomial logit choice model. This paper simplifies it to a problem of finding a unique fixed point of a single-dimensional function and visualizes the assortment optimization process. An efficient algorithm to find the optimal assortment and prices is provided.

■ WB38

38- North 226 B- CC

Workforce Uncertainty and Optimization

Sponsor: Service Science

Sponsored Session

Chair: Yingdong Lu, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, yingdong@us.ibm.com

1 - Formulating and Solving Call Center Scheduling Models in Excel
Thomas Robbins, Assistant Professor, East Carolina University, College of Business, 3212 Bate Building, Greenville, NC, 27858, United States of America, robbinst@ecu.edu

Call Center scheduling models are often formulated as computationally intensive mixed integer programs. In this talk we examine the drivers of computational complexity and investigate the feasibility of solving these models in what is often the supervisor's tool of choice– Excel. We present a number of different deterministic and stochastic formulations and discuss strategies to achieve practical solution time frames using the Excel-based Risk Solver Platform engine.

2 - Proactive Retention
Kush R. Varshney, IBM Thomas J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, United States of America, krvarshn@us.ibm.com, Moninder Singh, Jun Wang, Yingdong Lu, Aleksandra Mojsilovic, Mark Squillante

Voluntary attrition is a costly problem for organizations with large workforces. In this work, we develop a methodology to predict employees at risk of resigning and develop analytics and optimization methods to determine retention bonuses in the form of salary increases for employees that provide the optimal monetary benefit to the organization. We demonstrate the approach on data from a real-world corporation.

3 - Hierarchical Target Setting for Large Enterprise
Yingdong Lu, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, yingdong@us.ibm.com, Debarun Bhattacharjya, Mark Squillante

We formulate and solve a stochastic optimization problem to determine performance targets for large enterprises with a complex hierarchy. Solution techniques and structural properties of the stochastic optimization are discussed. Numerical experiments show that our approach provides better targets than several widely adopted business practices.

■ WB39

39- North 226 C- CC

OM-Marketing Interface: Pricing II

Contributed Session

Chair: Mingxi Zhang, PhD Student, Guanghua School of Management, Peking University, Room502, Building#3, ZhongGuanXinYuan, Beijing, 100871, China, mxzhang@pku.edu.cn

1 - Valuation of Options in Media Revenue Management
Mingchang Wu, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States of America, mingchang.wu@business.uconn.edu, Suresh Nair, Srinivas Bollapragada, Lakshman Thakur

TV companies sell the bulk of their advertising slots in an upfront market. We analyze the pricing problem for some options sold in this market by TV networks which allow clients to pull back and/or to buy additional advertising at upfront prices in the future. At present, the sold slots in upfront market are generally not callable. We explore the benefit of having advertising slots to be callable by the TV network.

2 - Discount Voucher: A New Mechanism for Revenue Management and Promotion in the Service Industry

Jian Chen, Professor, Tsinghua University, School of Economics and Management, Beijing, 100084, China, jchen@tsinghua.edu.cn, Fei Gao

In this paper, we discuss the discount voucher mechanism from both marketing and operations perspectives. By incorporating the potential future effect into a revenue management model, we get seller's optimal capacity allocation decision between the discount voucher channel and spot selling channel. Then we extend our model to incorporate voucher buyers' no-show behavior and by considering customer herding behavior.

3 - Selling Generators to Strategic Consumers with Sales Returns

Zhuping Liu, University of Texas at Austin, 1 University Station, Austin, TX, 78712-1178, United States of America, liuzhuping03@gmail.com

We consider a retailer who decides the order quantity and the return fee when selling generators to consumers around hurricane time. All consumers face valuation uncertainty and realize their valuation simultaneously only after the hurricane. A generator can be returned to the retailer only if it is unused. We find a retailer would induce late purchase if the blackout probability is relatively low and induce early purchase only if the blackout probability is relatively high.

4 - Delivery Capabilities and Product Price and Sales: Evidence from Transactional Data

David Peng, Assistant Professor, University of Houston, College of Business, Houston, TX, 77204, United States of America, david_peng99@yahoo.com

This study examines whether delivery capability of a manufacturer enables the manufacturer to charge a higher unit price, and if so, what aspects of delivery capability are more important. The hypotheses are tested using data associated with more than 30,000 customer orders of a manufacturer over three years. The results indicate that delivery capability is positively associated with the unit price the manufacturer charges its customers.

5 - Pricing Strategy with Information Dissemination

Mingxi Zhang, PhD Student, Guanghua School of Management, Peking University, Room502, Building#3, ZhongGuanXinYuan, Beijing, 100871, China, mxzhang@pku.edu.cn, Ming Lei, Xiaona Zheng

This paper considers a monopoly's two-stage pricing strategy with the presence of information dissemination. Information shared by informed customers changes less-informed customers' product assessment and willingness to pay. We find that lowering price in phase I to induce information diffusion is optimal only when the information gap is moderate and the cost of information-sharing is small compared to the marginal value of information under the adjustment of discount factor.

■ WB40

40- North 227 A- CC

Pricing in Energy

Contributed Session

Chair: Carolina GarcÌa-Martos, Technical University of Madrid, UPM, ETSII, C/ JosÈ GutiÈrrez Abascal, 2, Madrid, Spain, garcia.martos@upm.es

1 - Optimal Demand Response using Device Based Reinforcement Learning

Zheng Wen, Stanford University, Stanford, CA, 94305, United States of America, zhengwen@stanford.edu, Daniel O'Neill, Hamid Maei

By suitably adjusting energy prices, Demand Response (DR) can improve the operational efficiency of electrical grids and reduce emissions through shifting load in time horizon. Critical to a successful DR approach is learning the consequence of shifting energy consumption on consumer satisfaction, cost, and future energy behavior. We present a device-based Reinforcement Learning (RL) algorithm to address these issues. Our proposed RL algorithm also optimally schedules the operation of devices.

2 - Development of a Portfolio Management Model for Spot and Bilateral Electricity Markets

Reinaldo C. Garcia, Associate Professor, University of Brasilia-UnB, Campus Univ, Darcy Ribeiro, Faculdade de Tecnoligia, Brasilia, 70910-900, Brazil, rcgar@yahoo.com, Javier Contreras

We have developed a model to optimally allocate the energy between spot and bilateral contract markets using modern portfolio theory. A GARCH prediction model is implemented to predict prices and volatilities in a dynamic fashion, being applied to obtain an optimal risky portfolio.

3 - Linear Prices in Non-Convex Electricity Markets: Models and Algorithms

Mathieu Van Vyve, Professor, Universite Catholique de Louvain, 34, Voie du Roman Pays, louvain-la-neuve, 1348, Belgium, mathieu.vanvyve@uclouvain.be

Strict Linear Pricing in non-convex markets is a mathematical impossibility. In the context of electricity markets, two dierent classes of solutions have been proposed to this conundrum on both sides of the Atlantic. We formally describe these two approaches in a common framework, review and analyze their main properties, and discuss their shortcomings. We also propose a new market model that retains their most important properties.

4 - Two-sided Convex Hull Prices for Electricity Markets

Praneeth Aketi, The Ohio State University, 1971 Neil Ave., Columbus, OH, 43210, United States of America, aketi-venkata-se.1@osu.edu, Suvrajeet Sen, Talat Genc

Electricity prices are often predicted using dual multipliers from optimization models. In case of MILP models, such predictions are based on a variety of approximations, namely, convex hull, optimal LP-restriction, and relaxed complementarity. We will discuss new prices based on two-sided convex hulls, and present results comparing each of these methods.

5 - Optimal Combined Forecasts for Electricity Prices: Influence of Renewable Energies

Carolina García-Martos, Technical University of Madrid, UPM, ETSII, C/ José Gutiérrez Abascal, 2, Madrid, Spain, garcia.martos@upm.es, Eduardo Caro, Marìa Jesus Sánchez

An optimal model from the forecasting accuracy perspective is proposed, consisting of a combination of several univariate and multivariate time series models that account for the amount of energy produced with clean energies (particularly wind and hydro). The proposed combination of forecasts consist of weighting the best models, according to a Design of Experiments (DOE), so as to minimize the MAPE, the most popular accuracy metric in the context of electricity price forecasting.

■ WB41

41- North 227 B- CC

Business Case Studies in the Petrochemical and Petroleum Industries

Sponsor: Energy, Natural Res & the Environment/Mining

Sponsored Session

Chair: Marlize Meyer, Principal Operations Researcher, Sasol Technology, 1 Klasie Havenga Street, Sasolburg, 1947, South Africa, marlize.meyer@sasol.com

1 - Using Analytics at the Dow Chemical Company

Joseph Czyzyk, Advanced Analytics Math Modeler, The Dow Chemical Company, 2040 Dow Center, Midland, MI, 48674, JJCzyzyk@dow.com

We will present the growth of the Advanced Analytics group within Dow, the model for serving the various internal businesses, the analytics process, areas of application (enhanced sales forecasts, early insight for business units, and quick response to deteriorating economic conditions) and a project example showing how the use of simulation and historical data can aid Human Resources in planning for the talent needs of the company.

2 - Successful Case Study for Integration between Business and Analytics in the Propylene Value Chain

Nicaleen Van der Westhuizen, Sasol Technology, Synfuels Road, Secunda, South Africa, nica.vanderwesthuizen@sasol.com, Gerrit Streicher, Marlize Meyer

Molecules meant for chemical manufacturing were lost along a very integrated and dynamic value chain serving multiple businesses. Sound engineering principles were incorporated in an Excel based mass balance tool which was used hand in hand with an integrated simulation model of the Propylene Value chain. The combined analytics capability were able to identify pinch points and constrains in the value chain under different conditions and ultimately a road map for project implementation.

3 - Various Approaches to Business Cases for Enterprise-wide Analytics

Margery Connor, Senior Technology Strategist, Chevron, 6001 Bollinger Canyon Road, San Ramon, CA, 94588, United States of America, MHCO@chevron.com

Developing business cases for individual project is challenging. What about justifying an enterprise-wide initiative to grow modeling and analytics capability across the enterprise? We will present various approaches used and the advantages and pitfalls of each. Be warned, we will not be presenting any 'silver bullets'.

■ WB42

42- North 227 C- CC

Tranportation Planning

Contributed Session

Chair: Alberto Garcia-Diaz, Professor, The University of Tennessee, Industrial and Information Engineering, 410 East Stadium Hall, Knoxville, TN, 37996-0700, United States of America, agd@utk.edu

1 - Highway Level of Service Estimation with Heterogeneous Traffic
Vahid Hosseini, Assistant Professor, Sharif University of Technology, Azadi Street, Tehran, Iran, vhosseini@sharif.edu, Saeed Dehghani, Masoud Hamedi

Travel time is a direct and sensible indication of the level of service being provided to the road users. Due to the widely varying mix of vehicular dimensions and speeds, the road traffic in developing countries can be both heterogeneous and chaotic. This study focuses on level of service estimation for a highway system in Tehran. Analysis is based on travel time data that is collected using identification and re-identification of Bluetooth enabled devices in passing by vehicles.

2 - A Multi-modal Quasi-Dynamic Residential Location Model
Shikai Tang, The Institute of Transportation Studies at UC Davis, 2028 Academic Surge, Davis, Calif. 95616, Davis, CA, 95616, United States of America, skytang@ucdavis.edu

In this research, we develop a comparatively simple but theoretically coherent integrated urban land use-transportation model based on the maximum utility approach. The proposed model integrally estimate travel cost, location choice (residential location or firm's location) and their trade-off, and seamlessly integrate multi-mode travel into the maximal social welfare residential location choice model. This model is in quasi-dynamic context with multiple time periods.

3 - Transportation Planning and Scheduling for the Special Olympics 2014 National Games
Andrew Johnson, PhD Student, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, andrew.johnson@rutgers.edu, Yao Zhao

New Jersey will be host to the 2014 Special Olympics National Games. We build a mathematical model to address a general transportation issue for this event which results in the development of efficient routes and schedules. The objective will be cost efficiency, timeliness, and convenience, as well as risk mitigation.

4 - A Stochastic Traffic Assignment Model with Fuzzy Perceived Travel Time
Ramin Shabanpour Anbarani, Student, Sharif University of Technology, Iran,Tehran,Azadi Ave., Tehran, Iran, shabanpour.ramin@gmail.com, Yousef Shafahi, Seyed Mohammad Miralinaghi

In this research, the concept of fuzzy set theory, as a useful tool, is used to model the perceived travel time uncertainty. A route based stochastic traffic assignment model is introduced to consider the variety of drivers in the rout selection decision making process. In this regards, the utility of each path is determined based on a fuzzy index and optimism of drivers in their decisions.

5 - An Overview of Highway Cost Allocation Methods
Alberto Garcia-Diaz, Professor, The University of Tennessee, Industrial and Information Engineering, 410 East Stadium Hall, Knoxville, TN, 37996-0700, United States of America, AGD@UTK.EDU, DongJu Lee

HCA methods divide common costs of transportation facilities among all vehicle classes. Traditional methods are Incremental or Proportional. Non-traditional procedures are mostly based on game theory. The Generalized Method allocates a lower cost for classes in the grand coalition. The Shapley Value is the average marginal cost over all permutations of classes in the grand coalition. A new method based on the Aumann-Shapley Value allocates pavement thickness and traffic capacity costs.

■ WB43

43- North 228 A- CC

Design Engineering

Contributed Session

Chair: Maryam Hafezi, PhD Condidate, Wilfrid Laurier University, 1207-125 Lincoln Road, Waterloo, ON, N2J2N9, Canada, hafe1390@mylaurier.ca

1 - Globally Optimal Robust Design and Control of Plug-in Hybrid Electric Vehicles
Orkun Karabasoglu, PhD Candidate, Carnegie Mellon University, 5000 Forbes Ave., 402 Scaife Hall, Pittsburgh, PA, 15213, United States of America, karabasoglu@cmu.edu, Burak Yuksel, Jeremy Michalek

We propose a methodology for globally optimal design and control of plug-in electric vehicles that minimize lifetime costs over a distribution of driving patterns. The proposed method applies dynamic programming in an inner loop to optimize the control strategy while using the DIRECT algorithm in an outer loop to optimize the vehicle design ensuring system optimality. Results identify robust vehicle designs for a variety of driving patterns while providing a upper bound on lifetime costs.

2 - Consider-then-Choose Modeling and Optimal Decisions
Minhua Long, Graduate Student Research Assistant, Iowa State University, 2104 Black Engineering Building, Iowa State University, Ames, IA, 50011-2161, United States of America, mhlong@iastate.edu, Erin MacDonald, William Morrow

Optimizing product designs and prices requires models of consumer preferences to estimate revenues and thus profits. Marketing Science has recently enabled modeling of non-compensatory, rather than purely compensatory, decision processes. Using such models to optimize decisions, however, results in difficult non-smooth problems. This talk outlines research into techniques that can be employed in this setting. Examples in new vehicle design are provided.

3 - Design Optimization with a Categorical Response
Gonca Bacanli, Graduate Student, Middle East Technical University, Industrial Engineering Department, Ankara, Turkey, e138634@metu.edu.tr, Ozlem Ilk, Gülser Köksal

Designing products and processes that are robust to sources of variability is a key objective in modern quality engineering and control. In this study, a method is proposed based on logistic regression modeling and analysis of location and dispersion effects of design variables on a categorical response for this purpose. This method is compared to the others developed for the same purpose using several test cases and the results are discussed.

4 - The Conceptual Design and Estimated Costing of a 1-2 GWp CdTe PV Factory
Hershall Shelley, Graduate Student/Professor, CSU/Mechanical Engineering Department, 100 Engineering Complex, 2401 Greenlee Drive, Austin, Texas 78703, Austin, 78703, United States of America, colostate@engr.colostate.edu

Develop an interactive and tool that will provide the estimated costs for a defender 500 MWp and challenger 1-2 GWp CdTe PV factories.

5 - Regulations Impacts on the Environmentally Sustainable Products' Design
Maryam Hafezi, PhD Condidate, Wilfrid Laurier University, 1207-125 Lincoln Road, Waterloo, ON, N2J2N9, Canada, hafe1390@mylaurier.ca, Xuan Zhao, Victor Shi

Our objective is to understand the effects of governmental regulations on the total environmental quality when the manufacturer is facing a heterogeneous market of consumers with variety of environmental preferences. Results show the existence of the danger zone for the regulation is an inevitable threat for the environment.

■ WB44

44- North 228 B- CC

Supply Chain: Concepts for Risk Management

Contributed Session

Chair: Myles Garvey, Consultant, 98 Fencsak, Elmwood Park, NJ, 07407, United States of America, mylesgarvey@gmail.com

1 - Intra-organizational Practices and the Management of Supply Risk
Jason Riley, PhD Candidate, Clemson University, 100 Sirrine Hall, Clemson, SC, 29634, United States of America, riley3@clemson.edu, Janis Miller, V. Sridharan

We develop an empirical study to investigate how certain intra-organizational practices can be used to reduce the uncertainty associated with supply and its movement through the supply chain. Using survey data collected from procurement professionals, we examine the effect of key internal practices in significantly reducing the level of supply risk. We also investigate if reducing supply risk leads to improved overall performance within the organization.

2 - Risk and Uncertainty Beyond Supply Chains
Andrew Coburn, Risk Management Solutions, 30 Monument Street, London, United Kingdom, Andrew.Coburn@rms.com, Giovanni Giallombardo, Daniel Ralph, Simon Ruffle

A supply chain provides a skeleton for an end-to-end management model of a manufactured product. This is convenient for addressing interruptions to sources (nodes) or deliveries (links) of materials or parts. We are interested in extensions such as the dynamics of production and transportation coupled with inventory; and threats to the supply chain and business system, such as exchange rate uncertainty. We report progress based on models of industrial case studies.

3 - The Management of Risk in Supply Chains: A Network Approach

Myles Garvey, Consultant, 98 Fencsak, Elmwood Park, NJ, 07407, United States of America, mylesgarvey@gmail.com, Steven Carnovale, Sengun Yeniyurt

Risk management is a common tenet in the planning of supply chains and distribution channels. To better analyze the implications of this interconnectedness for risk management, we formulate a network theoretic model of supply chain risk. We then generate scalable measures of risk applicable regardless of the industry or size of the supply chain.

4 - An ISM ANP Integrated Framework for Sustainable Supply Chain Planning

Anjali Awasthi, Concordia University, CIISE-EV7.640, 1515, Ste. Catherine Street W, Montreal, QC, H3G2W1, Canada, awasthi@ciise.concordia.ca, Hussain Mohammad

There is a growing need for sustainability planning in supply chains to reduce the negative environmental impacts and efficiently meet the customers' demands. In this paper, we present an ISM-ANP based framework for evaluating sustainable supply chain alternatives. ISM is used to identify the relationship between different social, economic, environmental criteria used for sustainability evaluation. ANP is then used to rank the alternatives. A numerical application is provided.

5 - Supply Risk Management in an Export-Processing System

Long Gao, Assistant Professor, University of California-Riverside, 221 AGSM, Riverside, CA, 92521, United States of America, long.gao@ucr.edu, Zhaolin Li

This paper studies a supply risk management problem in the export-processing trade model, where the retailer who has a certain targeted purchasing quantity, supplies an appropriate amount of raw materials, and the supplier receives the processing fee for processing and exporting the final products. The supplier faces stochastically proportional yields.

■ WB45

45- North 229 A- CC

Joint Session MI/HAS: Modeling and Analysis in Healthcare

Sponsor: Minority Issues & Health Applications Society

Sponsored Session

Chair: Hector Toro-Diaz, Clemson University, 204 Freeman Hall, Clemson, SC, 29634, United States of America, htoro@clemson.edu

1 - Technology-enhanced Care Management Reduces Depression among Minority Diabetics: Preliminary Findings

Shinyi Wu, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240C, Los Angeles, CA, 90089, United States of America, shinyiwu@usc.edu, Jeffrey Guterman, Pey-jiuan Lee, Irene Vidyanti, Caitlin Hawkins, Kathleen Ell, Pai Liu

Preliminary depression trial results are reported for a comparative study among low-income, primary care, minority diabetes patients. Depression care is guided by a collaborative team care protocol. In one study arm, 500 patients also receive automatic telephonic depression symptom assessment over time and their providers automatically tasked per protocol. At 6 months, patients in the technology arm have significantly lower PHQ-9 depression scores and are less likely to have major depression.

2 - Patient Care and Resource Management Optimization

Monica Puertas, University of South Florida, 4202 E. Fowler Ave., ENB 118, Tampa, FL, United States of America, mpuertas@mail.usf.edu, Jose Zayas-Castro, Bo Zeng, Peter Fabri

The care of patients with multiple injuries demands a large amount of time, because most of them require total care over multiple stages and have very long length of stay, leading to extensive resource usage. The purpose of the proposed research is to integrate systems engineering methods with healthcare expertise for improving the delivery of care and the resource management, designing a well-planned treatment path to achieve the goal of safety, quality and progression.

3 - Estimates of Pre-pregnancy and Gestational Diabetes in US Women from 1980 to 2008

Hector Toro-Diaz, Clemson University, 204 Freeman Hall, Clemson, SC, 29634, United States of America, htoro@clemson.edu, Mulugeta Gebregziabher, Odette Reifsnider, Maria Mayorga, Kelly Hunt

We estimate the prevalence of diabetes (DM) during pregnancy in non-Hispanic white and non-Hispanic black women in the US from 1980 to 2008. Using sample data we fit a binomial regression model to estimate the risk of DM as a function of age, race/ethnicity, and BMI. This risk is applied to a simulated population to estimate maternal diabetes prevalence at the US population-level and quantify disparities.

■ WB46

46- North 229 B- CC

Industry-specific Sustainabiity Issues

Contributed Session

Chair: Saravanan Kuppusamy, PhD Student, Carl H. Lindner College of Business, University of Cincinnati, Department of OBAIS, 2925 Campus Green Drive, P.O. BOX 210130, Cincinnati, OH, 45221-0130, United States of America, kuppussn@mail.uc.edu

1 - Impacts of the Renewable Portfolio Standard on Regional Electricity Markets

Yingjue Zhou, Oklahoma State University, 502 Engineering North, Industrial Eng and Management, Stillwater, OK, 74078, United States of America, yingjue.zhou@okstate.edu, Tieming Liu

We examine the impacts of the renewable portfolio standard on regional electricity markets. We assume existing companies can build new renewable capacity or buy tradable green certificates or both. We establish a game theory framework to find the Nash equilibrium of the companies' pricing and capacity decisions under two market structures: regulated-monopoly (vertical-integrated) and single-buyer (two-echelon). We compare the results and find the conditions where one option dominates the other.

2 - Flexibility Design in Public Bicycle Sharing System with Redistribution

Meilin Zhang, Graduate Student, NUS Business School, 03/44, GSA 13, PGP's Residence, NUS, Singapore, Singapore, 118431, Singapore, g0900971@nus.edu.sg, Chung Piaw Teo, Mabel Chou, Qizhang Liu

Public bicycle sharing program has been deployed in hundreds of cities worldwide. However, few programs have managed successfully in terms of overall benefits (e.g. utilization rate, profitability) due to high start-up costs and challenging operations for efficiency.Our work greatly complements this sustainability commitment with a flexible redistribution design and proposes several robust redistribution control policies. The analysis is based on real transit data in Singapore.

3 - Analyzing Fleet Renewal Decision of Taxi Cabs with Electric Vehicles

Saravanan Kuppusamy, PhD Student, Carl H. Lindner College of Business, University of Cincinnati, Department of OBAIS, 2925 Campus Green Drive, P.O. Box 210130, Cincinnati, OH, 45221-0130, United States of America, kuppussn@mail.uc.edu, Michael Magazine, Uday Rao

We provide a research framework that captures interactions between a taxi cab company and an infrastructure provider. We show that Electric Vehicles (EV) are not suitable for low and high mile usages, however, they are beneficial for some intermediary range of miles. We also demonstrate the impact of variance in the miles driven and the heterogeneity of vehicles on the EV adoption.

■ WB47

47- North 230- CC

Shortest Path Searching Algorithms and Applications

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu

1 - A Variable Time Discretization Based Time-dependent Shortest Path Algorithm – Experience with Simulation-based Dynamic Traffic Assignment Model

Ye Tian, tianye@email.arizona.edu, Yi-Chang Chiu

This talk introduces two variable time discretization strategies applicable to time-dependent shortest path algorithms. The strategies are aimed at determining the optimal time discretization resolution of time-dependent travel time data for network links/nodes in order to achieve a desirable balance between solution accuracy and memory usage. The strategies are applied to a time-dependent shortest path algorithm in a simulation-based dynamic traffic assignment environment to study the computational properties of such strategies.

2 - Development and Numerical Analysis of a K-Short Path Ranking Algorithm

Xianbiao Hu, Research Assistant, University of Arizona, 1209 E. 2nd Street, Tucson, AZ, 85721, United States of America, xbhu@email.arizona.edu, Yi-Chang Chiu

In this research a k-Shortest Paths Ranking (SPR) algorithm is proposed to find k shortest paths between two given OD pairs based on a defined similarity degree. The similarity degree is used to regulate the similarity/overlapping of these k shortest paths. Numerical analysis conducted on the Tucson network show satisfactory results of the proposed algorithm.

3 - Searching for Parking on a Network: A Stochastic Shortest Path Approach

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, Sadeq Safaripoor

Parking is a significant component of any urban transportation system. This presentation introduces a network-based parking search model in a stochastic environment, along with a multi-user equilibrium formulation with recourse. This formulation can be used to predict the impact of changes in parking pricing or availability policies, or the introduction of parking information systems.

4 - Analysis of Online Stochastic Routing Approaches under Real-time Information

Lili Du, Purdue University, Nextrans Center, 3000 Kent Avenue, W Lafayette, IN, 47906-1075, ldu@purdue.edu, Srinivas Peeta, Yong Hoon Kim

This study develops online stochastic routing policies/algorithms incorporating real-time short-term link travel time distributions and travelers' preferences on travel time and its variability. Numerical experiments are illustrated to demonstrate the efficiency of the proposed approaches as well as the impacts of real-time information accuracy on the online stochastic routing.

■ WB48

48- North 231 A- CC

Facility Logistics V

Sponsor: Transportation Science & Logistics/ Facility Logistics

Sponsored Session

Chair: Yugang Yu, yyugang@rsm.nl

1 - Analysis of Order Picking Performance using Decentralized Control Strategies in Facility Logistics

Guido Follert, Department head, Fraunhofer IML, Jos.-v.-Fraunhofer Str. 2-4, Dortmund, 44227, Germany, Guido.Follert@iml.fraunhofer.de

Companies are challenged to increase the performance of supply and distribution even on the level of physical material flow. Therefore, the use of decentralized control strategies seems promising. Various new approaches exist from decentralized control to autonomous vehicles to organize the flow of units in order picking. Implications from the combination of order picking and decentral control strategies are discussed and a methodology to identify suitable configurations is provided.

2 - Rearrange-While-Working for Perpetually Organized Unit-Load Warehouses

Hector Carlo, University of Puerto Rico, Dept. of Industrial Engineering, P.O. Box 9043, Mayaguez, 00681, Puerto Rico, hector.carlo@upr.edu, German Giraldo

This study presents Rearrange-While-Working (RWW) as a strategy to optimize the process of rearranging a warehouse while serving a list of move requests. Due to the complexity of the problem, several heuristics are proposed. Experimental results indicate that the proposed heuristics perform satisfactorily in terms of solution quality and computational time.

3 - Robust Material Handling System Design Based on the Risk versus Cost Tradeoff

Marc Goetschalckx, H. Milton Stewart School of Systems and Industrial Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, marc.goetschalckx@isye.gatech.edu, Pratik Mital, Edward Huang

Major material handling systems have extended life times but are designed ignoring future uncertainty and rely only on mean-value data and algorithms. We present a design methodology that identifies all the Pareto-optimal configurations with respect to a cost and risk of a material handling system. The algorithm is structured such that the master problem makes the risk tradeoffs and the sub problem embeds the material handling system knowledge. Numerical experience will be shared.

■ WB49

49- North 231 B- CC

Pricing and Financing of Transportation Systems: II

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Siriphong Lawphongpanich, University of Florida, Industrial & Systems Engineering, Gainesville, FL, 32611, United States of America, lawphong@ise.ufl.edu

1 - A Shipper-Carrier Freight Transshipment Network Model: A Stackelberg Game-Theoretic Approach

Tao Yao, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, taoyao@psu.edu, Bo Zhang, Amir Meimand, Terry Friesz

This paper considers the shipper-carrier freight transshipment problem by a leader-follower game. The problem is formulated as a MPEC. Numerical experiments are conducted and some interesting insights about carrier's optimal pricing strategy are discussed.

2 - Assessing Dynamic Pricing Strategies using Integrated Demand and Network Models

Shanjiang Zhu, Assistant Research Scientist, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, zhuxx120@umd.edu, Ryan Jian, Chenfeng Xiong, Mostafa Mollanejad, Lei Zhang

This research develops an integrated demand and network modeling framework to assess dynamic pricing strategies. Behavioral reactions of route and departure time choices are considered through a positive agent-based demand model, while a Dynamic Traffic Assignment model is adopted to evaluate network dynamics. The integrated model is applied on the Inter-County Corridor in the metropolitan washington D.C. area.

3 - Integrated Pricing of Road and Power Networks Coupled by Electric Vehicles

Fang He, University of Florida, Civil and Coastal Engineering, Gainesville, FL, 32611, United States of America, jayhe@ufl.edu, Yafeng Yin

The deployment of electric vehicles will lead to more frequent and profound interaction between transportation and power systems. This paper analyzes the interaction between price of electricity and travel patterns of electric vehicles, and then develops mathematical models to determine optimal prices of electricity and roads to maximize social welfare associated with the coupled networks, under different authoritarian regimes.

4 - Differentiated Congestion Pricing of Urban Transportation Networks

Mahmood Zangui, University of Florida, mzangui@ufl.edu, Yafeng Yin, Siriphong Lawphongpanich

This paper explores a new type of congestion pricing that differentiates users with respect to their travel characteristics and charges them different amount of toll accordingly. The scheme can reduce the financial burden of travelers or lead to more substantial reduction of congestion. Given that the scheme requires tracking travelers, methods are proposed to mitigate the potential privacy concern or provide incentives for travelers to voluntarily reveal their private travel information.

■ WB51

51- North 232 A- CC

Modeling and Simulation for Military Logistics Support

Sponsor: Military Applications

Sponsored Session

Chair: Jeff Eaton, Director, Operations Research Solutions, Concurrent Technologies Corporation, 9570 Regency Square Boulevard, Suite 400, Jacksonville, FL, 32225, United States of America, eatonj@ctc.com

1 - Using a Decision Component Registry to Manage USMC Logistics Decision Support

Jeff Eaton, Director, Operations Research Solutions, Concurrent Technologies Corporation, 9570 Regency Square Boulevard, Suite 400, Jacksonville, FL, 32225, United States of America, eatonj@ctc.com, Aaron Burciaga

The USMC must ensure validated M&S capabilities are developed to support decisions to a myriad of critical logistics issues that face senior leaders. HQMC LX and CTC have developed a Decision Component Registry to improve the M&S decision support maturity across the logistics analytics community. This presentation will highlight this approach in managing their logistics decision support tools – ensuring that there is a clear, multi-echelon mapping between data systems, M&S tools and decisions.

2 - An Operations Research Contribution to Logistic Support Analysis

Rob Basten, Assistant Professor, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, r.basten@utwente.nl

Logistic support analysis (LSA) is a key tool for integrated logistics support and hence well known in the defense world. LSA consists of a number of tasks, of which only spares optimization has received abundant attention in the operations research (OR) literature; level of repair analysis has received some. We show that OR has much more to offer to aid the LSA process and that LSA poses interesting problems to OR researchers. Solving these will also aid companies outside the defense world.

■ WB52

52- North 232 B- CC

Biofuel Supply Chain Management and Operational Planning

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Guiping Hu, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu

1 - Analyzing the Impact of US Rail Transportation Network on Building a Sustainable Bioenergy Feedstock

Sandra Eksioglu, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, sde47@ise.msstate.edu, Md Roni

We develop models to optimize the transportation network for densified biomass from the preprocessing locations to existing coal plants for co-fire. The model takes into account the availability, seasonality and location of biomass throughout the US; and the incentive allowances offered by railway companies for efficient usage of their equipment.

2 - Competitive Bioenergy Facility Location Design under Probabilistic Disruptions

Xin Wang, University of Illinois at Urbana-Champaign, 111 E Healey St Apt 202, Champaign, Il, 61820, United States of America, Wangxin1@illinois.edu, Yanfeng Ouyang

Built supply chain facilities may lose functionality due to the competitions or probabilistic disruptions. We formulate a Stackelberg game model based on continuum approximation to comprehensively analyze the problem and find the optimal facility location design under spatial competitions, facility disruptions, and general transportation cost functions. A case study with the bioenergy industry is presented.

3 - A Supply Chain Management and Operational Planning Model for Biomass to Drop-in Fuel

Guiping Hu, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, gphu@iastate.edu, Leilei Zhang

US Department of Energy has identified pyrolysis platform as a promising biofuel pathway. In this paper, we present a biofuel supply chain model with Mixed Integer Linear Programming (MILP) methodology to investigate the facility location, facility capacity and gasoline distribution decisions in operational level for corn stover in US Midwest. By analyzing the unit production and transportation cost for gasoline, we are able to show that it is promising to use corn stove to produce gasoline.

4 - A New MINLP Model for Optimal Offshore Oil and Gas Field Development Planning under Contracts

Vijay Gupta, PhD Candidate, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, vijaygup@andrew.cmu.edu, Ignacio E. Grossmann

We propose a generic mixed-integer nonlinear programming (MINLP) model for investment and operations planning of a multiple Oil and Gas field site under complex fiscal rules that are defined by the contract with the host government. The model can be reduced to a variety of specific contracts. We show an improvement in the decisions using this model as compared to a simple NPV based approach. Solution strategies based on reformulation/approximations are proposed to solve the problem efficiently.

■ WB53

53- North 232 C- CC

Power-systems Transmission and Generation Expansions under the Presence of Renewable Resources

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Enzo Sauma, Pontificia Universidad Catolica de Chile, Vicuña Mackenna 4860, Macul, Santiago, Chile, esauma@ing.puc.cl

1 - An Enhanced Decomposition Approach for Large-scale Stochastic Transmission Planning Models

Francisco Munoz, PhD Student, Johns Hopkins University, 3400 North Charles Street, Ames Hall 319, Baltimore, MD, 21218, United States of America, francisco.munoz@jhu.edu, Benjamin Hobbs

There is a growing need for transmission-planning models that account for market uncertainties and generators' response. We propose a multi-stage stochastic transmission-planning model and describe an alternative solution approach for large-scale applications using Benders decomposition. We show significant improvements in the convergence rate of the upper and lower bounds when the traditional decomposition algorithm is enhanced with accelerating techniques.

2 - Evaluating Investment Options with Wind Integration using Markov Decision Processes

Athena Wu, PhD Candidate, The University of Auckland, 70 Symonds Street, Auckland, New Zealand, a.wu@auckland.ac.nz, Golbon Zakeri, Andy Philpott

Classical capacity planning models become problematic when evaluating investment facing wind generation intermittency. We describe a model treating the uncertainty in wind as a Markov Chain and the short-term operation of electricity plant as an average reward MDP. This problem's LP formulation can be augmented by binary variables defining investment actions, leading to a mixed-integer program. The impact of increasing wind penetration on generation and transmission investments is explored.

3 - Risk-averse Stochastic Optimization Models for Power Generation Capacity Expansion Problems

Maria-Teresa Vespucci, Associate Professor, University of Bergamo, via Marconi, 5, Dalmine, BG, 24044, Italy, mtvespucci@tin.it, Marida Bertocchi, Laureano F. Escudero, Stefano Zigrino

Multi-stage stochastic optimization models are introduced for the power generation capacity expansion problem of a price-taker power producer, taking into account regulatory constraints on CO2 emissions, incentives to generation from RES, evolution of power producer's market share and risk due to fuel price volatility, that affects the generation variable costs. Risk is accounted for by maximizing the expected profit while minimizing a suitably defined risk measure.

4 - Interaction between Transmission and Generation Investments and Their Influence in RPSs Designs

Enzo Sauma, Pontificia Universidad Catolica de Chile, Vicuña Mackenna 4860, Macul, Santiago, Chile, esauma@ing.puc.cl, Benjamin Hobbs, Francisco Munoz

We examine how the lumpiness of network expansions affects the performance of Renewable Portfolio Standards (RPSs). We found that disregarding transmission constraints or assuming that grid expansions can take place smoothly may result in overestimation of RPS compliance and underestimation of costs. We show that the interaction between flexibility and the discrete characteristics of grid expansions can have an important impact on the performance of RPSs.

■ WB54

54- Regency Ballroom A- Hyatt

Sensor-based Monitoring, Modeling and Analysis II

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Multiscale Recurrence Analysis of Long-term Nonlinear and Nonstationary Sensor Signals

Hui Yang, Assistant Professor, University of South Florida, Tampa, FL, 33620, United States of America, huiyang@usf.edu

Recurrence analysis is an effective data-driven tool to characterize and quantify the dynamics of complex systems, e.g., laminar, divergent or transition behaviors. However, recurrence computation is highly expensive as the size of time series increases. This paper presents a novel multiscale framework to explore recurrence dynamics in the complex systems and resolve the computational issues for the large-scale datasets. This approach was experimentally validated with real-world sensor signals.

2 - Performance Evaluation and Comparison for Different Prognostic Models

Junbo Sun, PhD Student, University of Wisconsin-Madison, 3255 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, json5@wisc.edu, Xiaofeng Mao, Shiyu Zhou, Mutasim Salman, Qiang Zhou

Fault prognosis plays an important role in reliability engineering. In this work, we present a quantitative evaluation and comparison of two prognostic models, namely, the degradation-signal based model and the Cox proportional hazard model based prognosis. We analyzed two models, and provided rigorous comparison results. They have been demonstrated through not only an analytic study, but also an extensive simulations followed by a practical case study using real data from the industry.

3 - Fault Tolerance Analysis of Surveillance Sensor Systems

Abhishek Shrivastava, Assistant Professor, City University of Hong Kong, Tat Chee Ave., Kowloon, Hong Kong-PRC, ashrivas@cityu.edu.hk, Elif Gokce, Yu Ding

A surveillance sensor system is a network of sensors that provides surveillance coverage to designated geographical areas. If all sensors are working properly, a well-designed surveillance system can provide adequate coverage. In reality, sensors may fail and become out-of-service. Motivated by the need to determine a surveillance sensor system's ability of to tolerate sensor failures, we propose a fault tolerance capability measure to quantify the robustness of surveillance systems.

■ WB55

55- Regency Ballroom B - Hyatt

Vehicle Routing Problems I

Contributed Session

Chair: Ching-Wu Chu, Professor, National Taiwan Ocean University, No. 2 Pei-Ning Road, Keelung, 20224, Taiwan - ROC, cwchu@ntou.edu.tw

1 - An Iterated Local Search Heuristic for the Multi-compartment Vehicle Routing Problem

Lin Hsiao-Yu, National Taiwan University of Science and Technology, No.43, Sec. 4, Keelung Rd., Daan Dist., Taipei, Taiwan-ROC, M10001108@mail.ntust.edu.tw, Vincent F. Yu

This study proposed an iterated local search (ILS) heuristic for the multi-compartment vehicle routing problem (MC-VRP). MC-VRP concerns with the design of least cost vehicle routes to satisfy customers' demands of multiple products. Applications of MC-VRP include the delivery of dairy products and fuels of different grades. The proposed ILS heuristic for MC-VRP is tested on 14 benchmark instances, and its results are competitive with existing approaches.

2 - Heuristic Algorithms for a Rolling Period Routing Problem

Ching-Wu Chu, Professor, National Taiwan Ocean University, No. 2 Pei-Ning Road, Keelung, 20224, Taiwan-ROC, cwchu@ntou.edu.tw, Hsiu-Li Hsu, Chao-Sheng Wu

A Period Vehicle Routing Problem with delivering ice cream products is faced by a company. Due to fluctuating demand in different seasons, the company deals with delivery work by outsourcing. Currently, the company satisfies most orders on next day based on personal experience. The objective of the studied company is to satisfy all orders and minimize the monthly transportation cost. Our proposed heuristic algorithms bring promising savings of the transportation cost.

■ WB56

56- Curtis A- Hyatt

Determiners of Innovation: Governments, Firms & Individuals

Sponsor: Technology Management

Sponsored Session

Chair: Eyiwunmi Akinsanmi, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA, 15213, United States of America, eyiwunmi@cmu.edu

1 - The Effect of Labor Market Mismatches on Entrepreneurship

Briana Sell, Doctoral Student, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, Bsell3@gatech.edu, Henry Sauermann

The objective of this study is to gain a deeper understanding of the sources and consequences of job mismatches in the Science and Engineering labor force using SESTAT survey data. The novel contribution is that it links mismatches to transitions into entrepreneurship among high ability workers. We hypothesize that mismatches are associated with a higher likelihood of entry into entrepreneurship since founding one's own firm may allow workers to mitigate negative consequences of mismatches.

2 - The Mobility of Scientists during Economic Downturns and its Impact on Technology Trajectories

Eyiwunmi Akinsanmi, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA, 15213, United States of America, eyiwunmi@cmu.edu, Ray Reagans, Erica Fuchs

We investigate how inventor mobility after the burst of the telecommunications bubble impacts innovation using 350 hand-collected resumes of U.S. photonics inventors. Our preliminary results suggest that emerging technology inventors that move to new markets increase innovation, driving national trends. In addition we find that using patents alone – without the additional information provided in CVs as has been done in the past – fails to provide these insights.

3 - Collaborator Novelty and Creativity: Evidence from DARPA and MIT

Phech Colatat, PhD Candidate, Massachusetts Institute of Technology, Sloan School of Management, E62-359, Cambridge, MA, 02142, United States of America, pcolatat@mit.edu

There have been numerous attempts to understand the innovation model of the Defense Advanced Research Projects Agency (DARPA), a highly regarded R&D organization. In this paper, I uncover one aspect of the DARPA model using data from MIT patent disclosures. Recent research on collaboration and creativity suggests that repeated collaborations can be detrimental to creativity. Consistent with this literature, I find that DARPA-funded research is less likely to involve repeated collaborations.

4 - Gains from Others' Losses: The Technology Trajectories and the Global Division of Firms

Chia-Hsuan Yang, Carnegie Mellon University, Department EPP, Baker Hall 129, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, chiahsuy@andrew.cmu.edu, Erica Fuchs, Rebecca Nugent

After the burst of the telecom bubble in March 2000, the majority of U.S. optoelectronic component firms moved manufacturing offshore. This research explores (1) whether due to the different offshore production economics, the firms who move manufacturing offshore stop or slow U.S.-based R&D activities in particular technologies and (2) whether inventors originally within these offshoring firms, leave, and continue to innovate in the pre-offshoring technologies at different institutions.

■ WB57

57- Curtis B- Hyatt

Data-Based Applications in Call Centers

Sponsor: Applied Probability

Sponsored Session

Chair: Rouba Ibrahim, Department of Management Science and Innovation of University College London, Gower Street, London, UK, WC1E 6BT, London, United Kingdom, rouba.e.ibrahim@gmail.com

1 - Little's Law: Statistical Analysis with Data

Song-Hee Kim, Columbia University, 500 W 120th Street, New York, NY, United States of America, sk3116@columbia.edu, Ward Whitt

Little's law relates limits of averages and expected values of stationary distributions, but we often consider averages from data over a finite time interval. With these empirical averages, we propose adjusted estimates to reduce bias when the system does not start and end empty. For stationary intervals, we advocate estimating confidence intervals. Data from simulations and a call center are used.

2 - Data-based Analysis of Delay Estimators and Announcements in a Call Center

Oualid Jouini, Assistant Professor, Ecole Centrale Paris, Grande Voie des Vignes, Chatenay-Malabry, 92290, France, oualid.jouini@ecp.fr, Zeynep Aksin, Yves Dallery, Fikri Karaesmen, Mohamed Salah Aguir

The problem of estimating delays experienced by customers with different priorities, and determination of the appropriate delay announcement, in a multi-class call center with time varying parameters, abandonments and retrials is considered. Making use of real data from this call center, the delay announcements from the estimated delay distributions that minimize a newsvendor-like cost function are considered. The performance of these announcements are also compared to announcing the mean delay.

3 - Forecasting Call Center Arrivals: Mixed and Bivariate Models

Rouba Ibrahim, Department of Management Science and Innovation of University College London, Gower Street, London, UK, WC1E 6BT, London, United Kingdom, rouba.e.ibrahim@gmail.com, Pierre L'Ecuyer

We consider different statistical models for the call arrival process in telephone call centers. We evaluate the forecasting accuracy of those models by describing results from an empirical study analyzing real-life call center data. Our study shows the importance of accounting for alternative correlation structures in the data.

4 - Forecasting and Staffing Call Centers with Multiple Uncertain Arrival Streams

Han Ye, University of North Carolina at Chapel Hill, 318 Hanes Hall, CB 3260, Chapel Hill, NC, 27599-3260, United States of America, hanye@email.unc.edu, James Luedtke, Haipeng Shen

We study the integrated problem of forecasting and staffing call centers with multiple uncertain arrival streams. We develop models to forecast multi-stream call arrivals, by considering three types of Inter-Stream Dependence (ISD). With the forecasts, we use a chance-constraint formulation to generate staffing vectors and further assess the operational effects. Our theoretical and numerical analyses bring insights into how various types of ISD affect forecasting and operational practice.

■ WB58

58- Phoenix East- Hyatt

Markov Decision Processes and its Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Sandjai Bhulai, VU University Amsterdam, Faculty of Sciences, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, s.bhulai@vu.nl

1 - Convergence Properties of Truncated Markov Decision Processes with Unbounded Jump Rates

Flora Spieksma, Leiden University, Mathematical Institute, Niels Bohrweg 1, Leiden, 2333, Netherlands, spieksma@math.leidenuniv.nl

Modern queueing applications require allowing the jump rates to be unbounded. This yields a non-uniformisable MDP, to which value iteration cannot be applied. Truncation methods have to be applied, but these generally destroy structural properties. Our new method smoothed rate truncation however preserves these. We discuss conditions under which optimal strategies for the truncated model converge to an optimal strategy for the original model. We illustrate this with a webfarm application.

2 - A Generalized Mu-c Rule for a K-competing Queues Model with Customer Impatience

Herman Blok, PhD Student, Leiden University, Mathematical Institute, Niels Bohrweg 1, Leiden, 2333 CA, Netherlands, blokh1@math.leidenuniv.nl, Flora Spieksma, Sandjai Bhulai

Without impatience it is known, that it is optimal to allocate the server to a queue according to the mu-c rule. The system can be modelled as an MDP with unbounded jump rates. There has been no systematic way to analyse such MDPs because these are not uniformisable. However, using the newly developed technique Smoothed Rate Truncation, we can prove that under some extra conditions the mu-c rule is still optimal. Without these conditions the mu-c rule is not necessarily optimal.

3 - Optimal Resource Allocation in Processor-sharing Systems with Feedback

Sandjai Bhulai, VU University Amsterdam, Faculty of Sciences, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, s.bhulai@vu.nl, Chretien Verhoef

We study a processor-sharing system with feedback in which the server capacity can be allocated over the different job classes to minimize the average number of jobs in the system. This seemingly simple model has a few peculiar properties. First, the optimal policy is an analogue of the SEPT policy. Second, numerical calculation of the optimal policy is hindered by boundary effects due to truncation of the state space. To resolve this problem, we develop a new numerical method.

■ WB59

59- Phoenix West- Hyatt

Scaling and Dynamics for Stochastic Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Ton Dieker, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, ton.dieker@isye.gatech.edu

1 - Validity of Heavy-traffic Steady-state Approximations in Many-server Queues with Abandonment

J.G. "Jim" Dai, Professor, School of ORIE, Cornell University (on leave from Georgia Institute of Technology), 221 Rhodes Hall, 136 Hoy Road, Ithaca, NY, 14853, United States of America, jim.dai@cornell.edu, Xuefeng Gao, Ton Dieker

We consider GI/Ph/n+M parallel-server queues that have a renewal arrival process, a phase-type service time distribution, n homogenous servers, and an exponential patience time distribution with positive rate. We show that in the Halfin-Whitt regime, under exponential integrability assumptions on the distribution of interarrival times, in steady-state, a pair of total-customer-count process and server-allocation processes, normalized by the square root of n, is tight.

2 - Simple Markovian Model of a Limit Order Book

Elena Yudovina, University of Michigan Department of Statistics, West Hall, 1085 South University Ave., Ann Arbor, MI, 48109, United States of America, e.yudovina@statslab.cam.ac.uk

We consider a simple Markovian model of a limit order book, in which the arriving limit orders have identical price distributions independent of the state of the limit order book. We examine the surprising dynamics of the resulting process, and characterise the three different regions with different steady-state behaviours.

3 - Order Cancellations in a Limit Order Book Market

Xuefeng Gao, Georgia Institute of Technology, 765 Ferst Dr, Main Building 332, Atlanta, GA, 30332, United States of America, gxf1240@gatech.edu, Ton Dieker, J.G. "Jim" Dai, Shijie Deng

Limit order books are used to match buy and sell orders in the majority of today's financial markets. In this talk, we study the cancellations of limit orders through reconstructing the order book from order flow message data of stocks traded on NYSE Arca. We found that for both buy and sell orders, the probability distribution of price levels (relative to the same-side best quote) where cancellations occur exhibit heavy tail. We also found the life-duration of cancelled orders placed at different price levels is far from exponential. These empirical observations reflect the strategic behavior of traders. They also suggest that understanding order cancellation is important for modelling a realistic order book and designing useful trading strategies.

4 - High-dimensional Sampling and Shake-and-bake Algorithms

Ton Dieker, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, ton.dieker@isye.gatech.edu, Santosh Vempala

This talk discusses a method for sampling from the boundary of an n-dimensional convex body using Markov chains, where we think of n as being large. We analyze a Markov Chain Monte Carlo procedure known as the shake-and-bake algorithm. The methodology is applied to the ranking-and-selection problem from the theory of simulation.

■ WB60

60- Remington- Hyatt

Market Microstructure

Sponsor: Applied Probability

Sponsored Session

Chair: Josh Reed, New York University, Stern School of Business, New York, NY, United States of America, jreed@stern.nyu.edu

1 - A Game Theoretic Approach to Funding Liquidity Modeling
Andrey Krishenik, Cornell University, 222 Rhodes Hall, Ithaca, NY, United States of America, ak757@cornell.edu, Johannes Wissel, Andreea Minca

We study the liquidity position of a financial institution that funds its operations through short term debt in a multi period setting: in each period creditors observe the company's P&L and decide on the amount they invest. Creditors make their decisions based on the P&L process. Our results show that there exists a liquidity barrier, such that, in all Nash equilibria, if the liquidity position falls below this barrier, there will be a run by short term creditors, that will lead to illiquidity.

2 - A Multiscale Model of High-frequency Trading
Richard Sowers, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, r-sowers@illinois.edu, Xiangqian Meng, Andrei Kirilenko

We propose and study a model of high-frequency trading. Our effort centers around a multiscale asymptotic analysis which depends on fluid and diffusive limits for order queues.

3 - Optimal Order Routing in Limit Order Markets
Arseniy Kukanov, PhD Candidate, Columbia University, 544 West 113 Street, 2R, New York, NY, 10025, United States of America, arseniy.kukanov@gmail.com, Rama Cont

We formulate and solve a problem of optimal limit order routing and study how an interplay between the state of order books, the fee structure, order flow properties and preferences of a trader influence his routing decision. In a case when one exchange is used for order execution we derive a closed-form solution for optimal limit and market order sizes. We also propose and test a stochastic algorithm for solving this problem in general order execution applications with multiple exchanges.

■ WB61

61- Russell- Hyatt

Joint Session: Emerge Mgmt/MAS: Decision Models for Counter-terrorism and Cyber Security

Cluster: Applications in Emergency Management and Terrorism Security & Military Applications

Invited Session

Chair: Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - Gain-loss Framing, Near Misses, and Cyber Security
Richard John, Associate Professor of Psychology, University of Southern California, Los Angeles, CA, United States of America, richardj@usc.edu, Heather Rosoff

Cyber security depends on user decision making under uncertainty. We describe the role of near misses on cyber security decision making and a model of such decisions that accounts for the reference point used by the decision maker. We report behavioral lab studies that characterize the role of gain-loss framing on such cyber security decisions.

2 - Game-theoretic Analysis of Attack and Defense in Coupled Cyber-physical Network Infrastructures
Fei He, University at Buffalo, 330 Bell Hall, Buffalo, NY, 14260, United States of America, feihe@buffalo.edu, Jun Zhuang, Nageswara S. V. Rao

Critical infrastructures rely on cyber and physical components that are both subject to natural, incidental or intentional degradations. In this paper we use game-theoretical approach to study the interaction between the attacker and the defender in the coupled cyber-physical network infrastructure. Both analytical and numerical results are presented to illustrate the models. Our research provides some novel insights into the survival and operations of such infrastructures.

3 - Cost of Equity in Defensive Resource Allocations in the Face of a Strategic Attacker
Xiaojun Shan, University at Buffalo, The State University of New York, 435 Bell Hall, Buffalo, NY, 14260, United States of America, xshan@buffalo.edu, Jun Zhuang

We study trade-off between equity and efficiency by developing a game-theoretic model, where a government allocates defensive resources among multiple potential targets, while reserving a portion (represented by the equity coefficient) for equal distribution (according to geographical areas, population, density, etc.) The attack probabilities are endogenously determined. Cost of equity increases convexly in terms of additional expected loss.

■ WB62

62- Borein A-Hyatt

Outsourcing

Contributed Session

Chair: Shouqiang Wang, Assistant Professor, Clemson University, 131D Sirrine Hall, Clemson, SC, 29634, United States of America, shouqiw@clemson.edu

1 - Cycle Calibrated Outsourcing and Contract Manufacturing
Li Xuesong, Research Fellow, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong SAR, Hong Kong, China, xuesongli78@hotmail.com, John Liu

Ongoing studies of outsourcing and contract manufacturing have generated an expanding body of models and empirics to explain why a new product is developed in the industrialized North and then manufactured in the less developed South. However, the dynamics of how to make outsourcing decisions remains unexplored and unstudied. We present a model of cycle calibrated outsourcing, where manufacturing technologies are calibrated over a product cycle with diffusion specifics.

2 - The Role of Global Direct Sourcing in Supply Chain Strategy
Qiong Chen, Clemson University, Department of Management, 100 Sirrine Hall, Clemson, SC, 29634, United States of America, qiongc@clemson.edu, Aleda Roth, Tracy Johnson-Hall

This study compares global direct sourcing (GDS) with traditional intermediated sourcing strategies. While GDS can provide some relative advantages over traditional sourcing, it is characterized by high levels of complexity and may introduce new sources of supply risk. We discuss when GDS can be advantageous as well as risk mitigation.

3 - Intellectual Property Licensing in a Production Outsourcing Environment
Tingting Jiang, Student, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, tingting-jiang@northwestern.edu

This paper studies the optimal licensing contract of an Intellectual Property (IP) vendor that generates profit from licensing innovation to a production sourcing market: the buyers that design the new product and the suppliers that manufacture the product. We show that the optimal contract depends on the market expectation on the profitability of the technology. We find that subsidy strategy is often used to encourage technology adoption.

4 - The Value of Commitment to Quality Monitoring and the Informational Role of a Third-Party Quality Company
Shouqiang Wang, Assistant Professor, Clemson University, 131D Sirrine Hall, Clemson, SC, 29634, United States of America, shouqiw@clemson.edu, Aleda Roth

We investigate the impact of the importer's ability of committing to quality inspection on her performance and the supply chain outcomes in an international procurement process. In particular, we examine the informational role a third-party quality company (3PQC) plays in restoring this commitment power for the importer. We find that the importer is not always better off by hiring a 3PQC. The timing of contracting with the 3PQC also plays a subtle, yet critical role.

■ WB63

63- Borein B- Hyatt

Supply Chain: Applications with Game Theory and Auctions

Contributed Session

Chair: Junghee Lee, PhD Candidate, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, leejun@wustl.edu

1 - Impact of Buyer-Supplier Cooperation in Buyer and Supplier Relationships

Tas Vijayaraghavan, Professor, XLRI, Jamshedpur, XLRI Campus, C.H.Area (E), Jamshedpur, Jh, 831035, India, tasviji@xlri.ac.in, Arijit Mitra, ISF Irudayaraj

It is our belief that Supply Management Orientation (SMO) should include cooperation variables too between suppliers and buyers before embarking on a SMO strategy. Towards this, we attempted an instrument, which we have termed it as "COURTESY". The study will focus on dimensions that have to be understood in the buyer-supplier cooperation and its impact on the supplier and buyer performance. An empirical study is underway to validate the "COURTESY" instrument.

2 - A Combinatorial Auction Revisited: Refinement and Extension of the PAUSE Auction Procedure

Selin Ahipasaoglu, Assistant Professor, SUTD, 20 Dover Drive, Singapore, 138682, Singapore, ahipasaoglu@sutd.edu.sg, J ames Orlin, Richard Steinberg

We examine the decentralized combinatorial auction PAUSE from an analytical and critical viewpoint. Specifically, we provide several refinements to the rules of the auction, and derive a number of results related to the revenue generated. We also propose a modification of the auction that has the potential to increase the revenue while retaining the auction's most desirable features.

3 - Contracting for Initial Acquisition and After-sales Service in the Presence of Lifetime Buy Planning

Dong Li, Rotterdam School of Management, Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, dli@rsm.nl, Nishant Mishra

We look at supply chain contracting under two types of after-sales service contracts- warranty+TBC and PBC, when lifetime buy decision has to be made to deal with parts obsolescence. The customer loses revenue if the equipment is not working, and where after-sales maintenance support can be an important revenue stream for the supplier after warranty. We compare the equilibria of different cases and find out the partners' decisions under various contracts.

4 - The Effect of Cost Sharing in a Decentralized Supply Chain

Yanmin Jiang, PhD Student, The HK Polytechnic University, Room 2025, No.1 Hung Lai Road, Student Hall of Residence, Polyu, Honghum, Hong Kong, Hong Kong-PRC, 09900910r@connect.polyu.hk, Hong Yan, Li Jiang

Independent suppliers who provide complementary components to the manufacturer may face capital constraints. The manufacturer can decide to share a proportion of each supplier's cost to relieve her from such restraint. Assuming that cost sharing augments the channel cost, we express the renewed cost as an exponential function of the cost sharing rates. In this paper, we show the manufacturer's optimal policy in cost sharing.

5 - Strategic Investment in a Budget Constrained Firm's R&D: Why, When and How

Junghee Lee, PhD. Candidate, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, leejun@wustl.edu

We model a supply chain in which a supplier's sales is linked with a manufacturer's costly R&D under asymmetric information about R&D budget. The supplier can influence on the downstream R&D investment by setting the wholesale price and/or subsidizing it. We find a threshold of budget under which the supplier pools the manufacturer using subsidy and price. If the budget is above the threshold, the supplier not only has the separating equilibrium but also achieves the first best.

■ WB64

64- Cowboy Artist- Hyatt

Accelerated Life Testing and Life Extension

Contributed Session

Chair: Seyed Niknam, University of Tennessee, 308 East Stadium Hall, Knoxville, TN, 37996, United States of America, sniknam@utk.edu

1 - Optimum Design of Stress Sequence Dependent ALT

Michael Koskulics, Rutgers University, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States of America, mkoskuli@rci.rutgers.edu, Elsayed Elsayed

In accelerated life testing (ALT), most models do not consider the effect of the sequence of applied stresses. One of the challenges in the design of ALT test plans for sequence dependent reliability models is the complexity associated with the large number of possible stress sequence permutations, particularly when many stress types or levels are considered. In this presentation, we develop a methodology based on the theory of scheduling to determine optimum test plans.

2 - Comparison between Constant-stress Testing and Step-stress Testing under Type-I Censoring

David Han, Assistant Professor, UTSA, One UTSA Circle, San Antonio, TX, 78249, United States of America, david.han@utsa.edu, Tony Ng

Running a test at higher stress than normal, accelerated life testing quickly yields information on lifetime distribution. In constant-stress testing, unit is tested at fixed stress level while step-stress testing allows to increase stress levels at some fixed points. In this talk, optimal k-level constant-stress and step stress life-tests are compared for exponential distribution under Type-I censoring. The objective is to quantify the advantage of step-stress test relative to constant-stress.

3 - Evaluation Optimal Design for Accelerated Life Testing Experiment with Time Censoring

Moein Saleh, PhD Student, Arizona State University, 699 S. Mill Ave., Mail code: 8809, Tempe, AZ, 85281, United States of America, msaleh1@asu.edu, Rong Pan

In recent years many studies are done on designing efficient experimentation for testing the reliability aspects of a product. These studies explore a method to apply type-I censoring and Accelerated Life Testing. In this study, we develop an exchange algorithm for generating optimal experimental designs for a failure time response variable with time censoring. Exchange Algorithm is more computational efficient than other methods, especially when a high-dimensional design space is considered.

4 - A Framework for Prognostic-based Real-time Life Extension

Seyed Niknam, University of Tennessee, 308 East Stadium Hall, Knoxville, TN, 37996, United States of America, sniknam@utk.edu, Wes Hines, Rapinder Sawhney

The primary objective of this research is to develop a prognostic-based life-extending framework. The obstacles in performing life-extension include: lack of knowledge (e.g. about aging mechanism), lack of tools (e.g. trust worthy prognosis algorithm), lack of data and lack of time. This research tackles important aspects of a prognostic-based life-extension program including: trend analysis of degradation data and prognosis algorithms for repairable systems.

5 - Network Based Approach for Studying Traumatic Brain Injury

Alla Kammerdiner, Assistant Professor, New Mexico State University, P.O. Box 30001, MSC 4230, Las Cruces, NM, 88003-001, United States of America, alla@nmsu.edu

According to the NINDS, traumatic brain injury (TBI) is a major public health problem. Systems based approaches may potentially be useful for improving our understanding of the biological mechanism of injury, since normal brain function requires integration of information from different areas. By taking advantage of recent advances in brain imaging and network science, we propose a new approach for studying TBI from the systems neuroscience perspective.

■ WB65

65- Cassidy-Hyatt

Data Mining in Medical and Biological Applications

Contributed Session

Chair: Marbelly Davila, PhD Candidate, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33617, United States of America, mdavila@mail.usf.edu

1 - A Minimum Spanning Tree (MST) Based Heuristic for Clustering High throughput Biological Data

Harun Pirim, King Fahd University of Pet. and Min., Systems Eng. Department, Dhahran, Saudi Arabia, harunpirim@gmail.com

The proposed heuristic uses MSTs to generate initial solutions and applies a local search to improve the solutions. The objective function considers both the tightness and the separation of the clusters. The heuristic is applied on several microarray datasets for which the actual partitions are known. Results show that the heuristic is a strong candidate to be used for clustering biological data. Moreover the objective function value can be used as a validation index for clustering algorithms.

2 - Classification of Major Congenital Heart Defects with Medical Image Data and Heart Models

Fariha Ejaz, Arizona State University, 699 S Mill Ave., Brickyard Engineering (BYENG) 553, Tempe, AZ, 85281, United States of America, fariha.ejaz@asu.edu, George Runger

Patient heart defects are difficult to recognize due to combinations and varying levels of abnormalities, even for healthcare professionals. An algorithmic tool, based on available heart CT data and computational models, to facilitate identification can be created through a series of classification techniques. The model will allow future inputs of unknown abnormalities. Statistical comparisons to the normal and abnormal structures present in the model will reveal underlying abnormalities.

3 - Non Linear Characterizing Measures of the EEG Time Series for Seizure Prediction

Paul Thottakkara, Student, University of Florida, 3415 SW 39th Blvd., Apt 1012, Gainesville, FL, 32608, United States of America, paulthottakara@gmail.com, Pando Georgiev, Panos Pardalos

Various similarities in the properties exhibited by non-linear systems and EEG signals have generated interest among researchers to use non-linear mathematical models to study epilepsy. The talk compares the performance of various existing non linear measures applied to EEG data and their limitations. Further, the talk focuses on a specific new measure of dependence expressed by cross cumulants and also analyze its performance in seizure detection.

4 - Predicting Surgery Duration using Data Mining Techniques

Marbelly Davila, PhD Candidate, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33617, United States of America, mdavila@mail.usf.edu, Grisselle Centeno

The prediction of surgery duration is a crucial factor for building reliable operating room schedules. The aim of this research is to compare the performance of several predictive techniques such as lasso regression, SVM, robust regression to model surgery duration using real surgical data.

5 - Quality of Life Issues for Sickle Cell Patients: KDDM Based Exploration

Gunjan Mansingh, Lecturer, The University of the West Indies, Mona Campus, Kingston, 7, Jamaica, gunjan.mansingh@uwimona.edu.jm, Monika Asnani, Kweku-Muata Osei-Bryson

Depression and loneliness is often associated with the genetic disorder sickle cell disease. In this paper we apply the knowledge discovery in data mining (KDDM) process to explore factors associated with depression and loneliness in such patients in Jamaica.

■ WB66

66- Ellis West- Hyatt

Understanding and Prediction of Societal Crises

Sponsor: Data Mining

Sponsored Session

Chair: Artur Dubrawski, Director, Auton Lab, Carnegie Mellon University, 5000 Forbes Avenue NSH 3121, Pittsburgh, PA, United States of America, awd@cs.cmu.edu

1 - The Expense of Desire

Kimberly Elenberg, Deputy Director, Population Health & Medical Management, Office of the Assistant Secretary of Defense, Health Affairs, 7700 Arlington Blvd., Suite 5101, 3M313, Falls Church, VA, 22042-5101, United States of America, Kimberly.elenberg@tma.osd.mil

Desire rather than reason often governs behavior. People generally want to be comfortable; therefore, management decisions are frequently made based on what has been proven through past experience to be effective. When past experience does not exist or has led to poor outcomes, Management Sciences can support speculation by maximizing functional integration through the application of advanced analytical methods. Assisting individuals with evaluating resources and structuring engagement in order to facilitate indulgence in speculation requires the establishment of *a priori* conditions that go well beyond the bounds of sense or association: resemblance, contiguity, and cause and effect. The outbreak of the rare and deadly Ebola virus killed several people in July 2012 in Midwestern Uganda. The strain of the virus was identified as Ebola Sudan, which in recent years has killed at a rate often above 70 percent of those infected. While outbreaks of different strands of Ebola occur every few years, the virus's delicate composition has impeded a sustained attack. But much about the disease, including its origins and cure, remain unknown and in this case, Ugandan authorities did not initially detect an Ebola outbreak because patients weren't showing typical symptoms of the lethal virus. Health organizations must reasonably comprehend the impact of a virus and, with confidence, manage an outbreak. To accomplish this, they must understand or predict the time evolution of the virus. In July, the particular Ebola-Sudan strain was comparatively mild to previous strains and therefore, less likely to stamp itself out. Infectious diseases evolve over time; the use of applied math and science has the ability to improve rational, meaningful forecasts of virulence leading to more efficient and effective management decisions which optimize the probability of making a practical impact. In this scenario, use of non-linear delay-differential equation describing the time evolution of the increment in the number of infectious individuals may assist with establishing virility and regression modeling can assist with establishing causation. Providing a link between past or present experiences with events that we can predict should facilitate a decrease in morbidity and mortality based on reason as result of rules-based activity.

2 - Using Machine Learning to Understand Dynamics of Conflict

Lujie Chen, Carnegie Mellon University, Pittsburgh, PA, United States of America, lujiec@cs.cmu.edu, Artur Dubrawski, Jen Ziemke

We show how machine learning can be used for the enhanced analysis of real-time event data, using 10,000 micro-level time- and geo-referenced reports of battle and civilian massacre events recorded over the 41-year Angolan civil war as an example. Why combatants sometimes opt to avoid targeting civilians, whereas at other times and places, massacres are rife? Our research suggests a fruitful synergy between applied computational models and scholars working in the expanding spaces of social and political science being flooded with large volumes of real-time event-based data.

3 - Learning to Detect Forest Fires

Vladimir Ermakov, Scanex R&D Center, 51k3 Smolnaya St 153, Moscow, Russia, vermakov@cmu.edu, Georgy Potapov, Artur Dubrawski

Large scale forest fires pose substantial challenges to safety, economy and societal stability. Satellite sensing is essential for their early detection and containment, and it has been used for over 10 years with significant efforts undertaken to improve its reliability. As new sensors come online a more scalable verification process becomes desirable. We propose to enable that by leveraging machine learning and by sourcing training data from volunteers via a purposively designed internet game.

4 - Monitoring Patterns of Sex Trafficking in the United States

Emily Kennedy, Carnegie Mellon University Auton Lab, 5000 Forbes Ave., Pittsburgh, PA, United States of America, emilyckennedy1@gmail.com, Saswati Ray, Artur Dubrawski

In recent years, the internet has become a popular tool for sex traffickers to advertise and sell their victims. We develop statistical algorithms to monitor publicly available sex service advertisements and group, classify, and characterize them in the context of patterns of potential interest to law enforcement and victim rescue organizations. We present approaches taken, summarize results obtained so far, and discuss their potential for mitigating this serious societal challenge.

■ WB67

67- Ellis East- Hyatt

Condition Monitoring and Prognostics

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Linkan Bian, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive, NW, Groseclose 0205, Room 417, Atlanta, GA, 30332, United States of America, linkanbian@gatech.edu

1 - Reliability of Nondestructive Evaluation for Aerospace Applications

Jeremy Knopp, The Air Force Research Laboratory, 2230 Tenth Street, Wright-Patterson AFB, OH, 45433, United States of America, Jeremy.Knopp@wpafb.af.mil, John Aldrin, Ramana Grandhi, Li Zeng

Reliability of Nondestructive Evaluation (NDE) in the US Air Force and other industries is quantified by probability of detection (POD) studies. The data can be collected as hit/miss or the response of an inspection instrument can be recorded. Recent efforts in model-assisted probability of detection (MAPOD) and advances in statistical analysis will be discussed.

2 - A Stochastic Framework for Sensory-based Prognostics in Synchronous Generators

Murat Yildirim, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, NW, Groseclose 0205, Room 415, Atlanta, GA, 30332, United States of America, murat@gatech.edu, Linkan Bian, Nagi Gebraeel

Despite their economic significance as the primary sources of electricity, synchronous generators have not benefited from sensory-based prognostics. The difficulty arises due to the large number of subcomponents and the complexities in their corresponding failure processes. This work uses physics of failure models to provide a closed-form expression for the remaining life distribution of synchronous generators. Degradation is modeled as a competing risks type stochastic process.

3 - Stochastic Modeling and Prognostics for Complex Systems with Discrete Interactive Degradation

Linkan Bian, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive, NW, Groseclose 0205, Room 417, Atlanta, GA, 30332, United States of America, linkanbian@gatech.edu

In many engineering systems, the lifetime distributions of the components are dependent. Many models on the reliability are developed on the premise that the components are independent. We present a degradation framework to model the degradation signals. We conduct a series of simulation studies and compare the performance of our approach with a model, which does not consider component independence.

4 - Health Index Development Based on Sensory Data Fusion for Degradation Modeling and Prognostics

Kaibo Liu, Research Assistant, H. Milton Stewart School of Industrial and Systems Engineering, 765 Ferst Drive, Room 109, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, kbliu@gatech.edu, Nagi Gebraeel, Jianjun (Jan) Shi

Due to the rapid development of sensor technology, integrating multiple sensor information to improve residual life prediction becomes more promising and challenging. This paper develops a novel data-level fusion technique that includes a generic chain of data selection, processing and fusion steps, specifically for degradation modeling and prognostic purposes. Case studies are conducted based on the aircraft gas turbine engine, which is generated by the C-MAPSS simulator at NASA.

5 - Optimal Replacement Models for a Wind Turbine Component

John Flory, PhD. Candidate, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, jhnflory@gmail.com, Jeffrey Kharoufeh

We present two partially-observed Markov decision process (POMDP) models for replacing a wind-turbine component based on observability of a stochastic operating environment. Component degradation is environment-driven and continuous. The POMDP models are solved using belief-projection, and numerical experiments suggest the existence of optimal threshold-type policies with respect to cumulative degradation.

■ WB68

68- Suite 312- Hyatt

Risk and Financial Decision-Making

Sponsor: Financial Services Section

Sponsored Session

Chair: Chanaka Edirisinghe, Professor, University of Tennessee, College of Business, Knoxville, TN, 37996, United States of America, chanaka@utk.edu

1 - The Effects of External Financing Costs on Investment Timing and Sizing Decisions

Michi Nishihara, Associate Professor, Osaka University, 1-7, Machikaneyama, Toyonaka, Osaka Prefecture, 560-0043, Japan, nishihara@econ.osaka-u.ac.jp, Takashi Shibata

We develop a dynamic model in which a firm exercises an option to expand production on either a small or large scale with cash reserves and costly external funds. We show that the financing costs distort the firm's financing and investment behavior and result in a policy contingent on the dynamics of the cash flow and reserves. Most notably, an intermediate level of cash reserves is likely to accelerate investment in the small-scale project. Our results fill the gap between previous findings.

2 - Planning for Optimal Liquidity Execution

Wei Chen, Principal Product Manager, SAS Institute Inc., SAS Campus Dr., Cary, NC, 27512, United States of America, Wei.Chen@sas.com

The challenging aspects of the recent regulation for liquidity risk are that banks must manage a hedging portfolio and frequently test its adequacy for liquidity exposures. Banks need to strategize its response to liquidity crisis. We propose a multi-stage linear program to optimize the liquidity execution. The optimization not only provides a solution in a distress but also helps build an a priori liquidity contingent plan. The model also helps banks prepare for non-sufficient CBC scenarios.

3 - The Credits that Count: Understanding the Drivers of Higher Education Credit Exposure and Defaults

Katharina Ley Best, PhD Candidate, University of Michigan Industrial and Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, katley@umich.edu, Jussi Keppo

Using a two-stage least squares model, we build a macroeconomic model of supply and demand for US higher education. We find that credit factors (student loan amounts and household debt) are primary drivers of demand. Further, we construct a hazard-based model of student loan defaults to estimate default probabilities for different types of students. We account for frailty correlation due to unobserved factors, macroeconomic conditions, and individual student characteristics.

4 - Integer Programs for Margining Option Portfolios by Option Spreads with More Than Four Legs

Dmytro Matsypura, Lecturer, University of Sydney, Rm 478, Merewether Building, Sydney, Australia, dmytro.matsypura@sydney.edu.au, Vadim Timkovsky

Margining is a crucial brokerage operation. It is especially challenging for option portfolios because offsets with options require solving an intractable IP. These offsets are based on option spreads with up to 4 legs. Option spreads with more than 4 legs allow the brokers to substantially increase the accuracy of margin calculations for option portfolios. We develop a theoretical framework for option spreads with any number of legs, formulate alternative IPs, conduct numerical experiments.

5 - Comparative Analysis of Capital Asset Pricing (CAPM) Betas Based on Tail Risk Measures

Konstantin Pavlikov, University of Florida, Gainesville, FL, 32611, United States of America, kpavlikov@ufl.edu, Stan Uryasev

The paper considers Capital Asset Price (CAPM) for tail risk measures: Conditional Value-at-Risk (CVaR) and Conditional Drawdown-at-Risk. We compared CAPM Beta based on Standard Deviation with Betas based on CVaR and CDaR. We ranked the performance of the hedge fund stiles using these new Betas.

6 - Support Vector Machines Based on Tail Risk Measures in Financial Applications

Peter Tsyurmasto, University of Florida, Gainesville, FL, United States of America, tsyurmasto@ufl.edu, Stan Uryasev

We considered several well-known Support Vector Machines (SVM) for classification and proposed a new SVM based on Value-at-Risk (VaR). Computational experiments with several Financial applications showed that the SVM based on VaR is not sensitive to large outliers.

■ WB69

69- Suite 314- Hyatt

Risk Management and Pricing in Operations

Cluster: Risk Management

Invited Session

Chair: Jie Ning, University of Michigan, Ann Arbor, Industrial & Operations Engineering, Ann Arbor, United States of America, jien@umich.edu

1 - Cost and Demand Uncertainties and Their Impacts on Pricing and Production Decisions

Sechan Oh, IBM Research, 650 Harry Road, San Jose, United States of America, seoh@us.ibm.com, Ray Strong

In contrast to manufacturing firms, service firms often face cost uncertainty as well as demand uncertainty when making pricing and production decisions. In this talk, we introduce a unified framework capable of examining the impacts of cost and demand uncertainties on the pricing and production decisions under different scenarios.

2 - Dynamic Pricing and Inventory Management for Systems with Dual Unreliable Suppliers

Xiting Gong, University of Michigan, 1205 Beal Avenue, Room 1815, Ann Arbor, MI, 48109, United States of America, xitingg@umich.edu, Xiuli Chao, Shaohui Zheng

We study the joint pricing and inventory replenishment problem for a system with random demand and two unreliable suppliers of different lead times. Suppliers may or may not be able to deliver an order in a period, and the delivery capability of each supplier evolves in a Markovian nature over time. We characterize the optimal policies in each period, and study the impacts of source diversification and supplier reliability on the firm and its customers.

3 - Applying the Concept of Credit Guarantee on Dual Sourcing Model

Cheng-feng Wu, PhD Student, National Taiwan University, 1, Sec. 4, Roosevelt Rd, Taipei, 106, Taiwan-ROC, d99741006@ntu.edu.tw, Po-Hua Chen, David Chiang, Jiuh-Biing Sheu

Capital shortage in SMEs causes them difficult to fulfill orders, resulting in poor performance of SC. Therefore, obtaining financial support for SMEs is a significant issue. This study attempts to examine the issue of trade guarantee mechanism from manufacturer's perspectives with dual sourcing. This study provides some suggestions to the supply chain under the trade guarantee mechanism.

■ WB70

70- Suite 316- Hyatt

Health Information Systems

Sponsor: Information Systems

Sponsored Session

Chair: Abhay Mishra, Georgia State University, Robinson College of Business, Atlanta, GA, 30030, United States of America, amishra@gsu.edu

1 - Virtualizing Medicaid Application Process in Georgia: A Test of Process Virtualization Theory

Abhay Mishra, Georgia State University, Robinson College of Business, Atlanta, GA, 30030, United States of America, amishra@gsu.edu, Patricia Ketsche, Angela Snyder, Susan Mclaren, James Marton

This paper examines the virtualization of Medicaid application process in the state of Georgia. We apply the process virtualization theory, which is particularly apt in this context, to examine the extent to which the Medicaid application process can be virtualized. We also examine the key moderating role that information technology can play in virtualization.

2 - Data-driven Order Set Optimization in the Pediatric Environment

Yiye Zhang, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, ichiyoz@gmail.com, Rema Padman, James Levin

Order sets have the potential to improve care delivery by making it faster, easier and safer for the clinician to enter orders, guided by known best practices. This research combines stochastic optimization with clustering to model the development of automated, data-driven order sets with the objective of minimizing usage costs.

3 - What Can We Learn from Online Doctor Ratings

Jiban Kuntia, Visiting Assistant Professor, Oakland University, Decision and Information Sciences Department, School of Business Administration, Rochester, MI, 48309, United States of America, Guodong Gordon Gao, Ritu Agarwal

This study examines various issues related to online doctor ratings, especially how the ratings are related to physician quality.

■ WB71

71- Suite 318- Hyatt

E Commerce

Contributed Session

Chair: Zhengliang Xue, IBM Research, 1101 Kitchawan Rd Route 134, Yorktown, NY, 10598, United States of America, zxue@us.ibm.com

1 - A Study on the Relationship between the Intensity of E-commerce Use and Business Performance

Byeong-Yun Chang, Ajou Univesity, San5 Wonchen Youngtong, Suwon, Korea, Republic of, bychang@ajou.ac.kr, Mato Magobe

In this research, the relationship between the intensity of e-commerce use and business performance is examined. For the research methodology factor analysis and structural equation modeling are used with data collected by using online questionnaires as well as personal delivery. The results shows that market pressure, perceived benefits and barriers to e-commerce use are jointly related to intensity of e-commerce use, which in turn is related to business performance.

2 - Collaborative Filtering and Constraint-based Personalized Recommendations for Tours over Internet

Lifang Peng, Professor, School Management, Xiamen University, Jiageng Builing No.1, Xiamen, 361005, China, lfpeng@xmu.edu.cn, Hong Zhan, Liang Zhang

In this paper, it is presented that an intelligent system to provide personalized recommendations for users in the tourism and travel domain. This system combines constrain-based recommendation and collaborative filter to suggest tours to users. The system uses constraint-based recommendation find some tours according with user's query, uses collaborative filtering to rate these tours combining information of user's demography and Purchase context, higher rate tours recommends to user.

3 - Pricing Strategy for Personalized Packages of Different Commodities

Zhengliang Xue, IBM Research, 1101 Kitchawan Rd., Route 134, Yorktown, NY, 10598, United States of America, zxue@us.ibm.com, Zizhuo Wang, Pawan Chowdhary, Markus Ettl

We study a method to price personalized packages of various commodities, e.g. hardware, software and service. The seller may have to price a personalized package without any sales history for the same configuration. We decompose each package to various components, and evaluate them based on features. We aggregate the component valuation to the package level, use segmentation model and choice model to estimate its win probability, and price the package to maximize the expected profit.

■ WB72

72- Suite 322- Hyatt

Adaptive Approximation Methods for Stochastic Optimization

Sponsor: Computational Stochastic Optimization

Sponsored Session

Chair: Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu

1 - Approximate Policies for Lagged Asset Acquisition Problems in Energy Resource Management

Xingyuan Ethan Fang, Princeton University, Sherrerd Hall Charlton St., Princeton, NJ, 08544, United States of America, xingyuan@princeton.edu, Warren Powell

In this talk, we will illustrate a new strategy to solve the multistage lagged asset acquisition problem motivated from energy market. The strategy is a hybrid of deterministic lookahead policy and value function approximation.

2 - Exploring Stochastic Optimization Solutions with Underspecified Discrete Joint Distributions

Luis Montiel, PhD, The University of Texas at Austin, 1 University Station, Austin, TX, 78703, United States of America, lvmontiel@gmail.com

We address the problem of optimization under uncertainty when the joint probability mass function (pmf) is underspecified. In such cases the pmf is itself a random vector with support in a convex polytope. Our approach uses a simulation procedure (JDSIM) that explores these polytopes and create a sampled collection of distributions. We show that JDSIM lead to solutions that in expectation provide better results than the traditional robust approach.

3 - Nonparametric Methods for Value Function Approximations using Dirichlet Clouds

Arta Jamshidi, Post Doctoral Research Associate, Princeton University, 119 Sherrerd Hall, Princeton, NJ, United States of America, arta@princeton.edu, Warren Powell

We present an on-line, fast and recursive non-parametric function approximation technique that does not require storage of data stream. The unique collection of these features is essential for modeling large data sets where storage of data becomes prohibitively expensive or updated information arrives. This design leads to an efficient way of value function approximation in the context of approximate dynamic programming for stochastic resource allocation in the presence of exogenous information.

4 - Analyses of Lagrangian Combined with Approximate Dynamic Programming

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Frank Schneider

The Lagrangian framework can be combined in several ways with approximate dynamic programming algorithm, e.g., Lagrangian can be used for each myopic problem or outside of approximate dynamic programming. We provide various algorithms, compare their respective bounds, and analyze convergence.

■ WB73

73- Suite 324- Hyatt

Flow Shop Scheduling I

Contributed Session

Chair: Hadi Panahi, PhD Candidate, Oregon State University, School of Mech., Indust., and Mfgr. Engr, 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, panahih@onid.orst.edu

1 - Minimizing Total Weighted Tardiness in Permutation Flow Shops with Sequence-dependent Setup Times

Christian Rathjen, Chair of Business Computing and Operations Research, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42119, Germany, crathjen@winfor.de, Stefan Bock

Permutation flow shop production systems in the process industry frequently pursue buffer-reducing JiT-policies, where tight time restrictions have to be met. In order to find suitable schedules, we propose three NEH-modifications along with a tabu search approach that make use of problem specific knowledge and improved neighborhood definitions. Its efficiency is validated by means of specifically designed benchmark instances in direct comparison with best state-of-the-art algorithms.

2 - Lower Bounding Methods for Hybrid Flowshop Scheduling with Dual Resources

Yasaman Mehravaran, PhD Candidate, Oregon State University, School of Mech., Indust., and Mfgr. Engr, 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, mehravay@onid.orst.edu, R. Logen Logendran

We propose a mathematical model to solve a hybrid flowshop scheduling problem with machines and labor as constraints. The goal is to minimize the work-in-process inventory while maximizing the service level. Labor has different skill levels and the setup is considered to be sequence-dependent. CPLEX is used to find the optimal solution in small instances. Logic based Benders decomposition and progressive relaxation are used to find a good lower bound in larger small instances.

3 - A Branch-and-Price Algorithm for a Flexible Flow Shop Scheduling Problem with Blocking Constraint

Hadi Panahi, PhD Candidate, Oregon State University, School of Mech., Indust., and Mfgr. Engr, 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, panahih@onid.orst.edu, R. Logen Logendran

A two stage flexible flow shop scheduling problem with batch processors in the first stage and discrete processors in the second stage is considered. Jobs are loaded in the batch processors based on predefined patterns. A setup might be required in the second stage. We present a branch-and-price (B&P) algorithm which considers each stage as a sub problem. The lower bound identified by this B&P algorithm is used to validate the result obtained from a computationally efficient search algorithm.

Wednesday, 1:30pm - 3:00pm

■ WC01

01- West 101- CC

Optimization Methods with Applications in Energy Systems

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Neng Fan, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM, 87185, United States of America, nnfan@sandia.gov

1 - Decentralized Charging Scheduling for Electric Vehicles using Mixed-Integer Nonlinear Programming

Dzung Phan, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, phandu@us.ibm.com, Jinjun Xiong, Soumyadip Ghosh

We propose a distributed decision-making scheme to model the charging of a collection of Electric Vehicles (EV). Our model introduces three characteristics to this problem: capacity constraints on the distribution grid, fair rationing of energy supply available under the capacity constraint, and discrete choice of EV charger settings. We study a distributed scheme based on the homotopy technique, which is able to efficiently solve the MINLP formulation.

2 - Study on Power Grid Defend-Attack-Defend with Line Switching

Bo Zeng, Assistant Professor, University of South Florida, 4202 E Fowler Ave., ENB118, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Wei Yuan, Long Zhao

Defend-Attack-Defend (DAD) Models are widely used in power grid contingencies and security studies. In this study, we consider line switching, one of the most effective operations to mitigate deliberate outages or attacks, in DAD model. We evaluate the benefits of transmission line switching by comparing the case without line switching.

3 - Optimal Wind Energy Commitments Considering Imbalance Cost and Allowed Imbalance Bands

Xiaoxuan Zhang, IBM TJ Watson Research, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, zhangxia@us.ibm.com, Bo Zhang

We study the optimal wind energy commitment problem. Our model incorporates the imbalance penalty and allowed imbalance bands. We provide the analytical characterizations of the optimal contract from the wind farm's perspective. We also study how to design the imbalance penalty mechanism from the ISO's standpoint, in order to ensure market efficiency.

4 - On the Vulnerability Assessment for Independent and Interdependent Networks

Yilin Shen, PhD Candidate, CISE Department, University of Florida, 296 Diamond Village, Gainesville, FL, 32603, United States of America, yshen@cise.ufl.edu, My Thai

The assessment of network vulnerability is of great importance in the presence of unexpected disruptive events targeting in critical network nodes. In this talk, we focus on identifying critical nodes in a network and an interdependent system, whose removals maximally destroy the network's functions. We provide a comprehensive complexity analysis of both problems, along with two efficient frameworks, a novel LP-based rounding algorithm, and a greedy framework with novel centrality functions.

■ WC03

03- West 102 B- CC

Retail Operations Management

Sponsor: Decision Analysis

Sponsored Session

Chair: Arcan Nalca, Assistant Professor, Queen's School of Business, Queen's University, Kingston, Canada, arcan.nalca@business.queensu.ca

1 - Product Assortment and Retail Pricing Strategies in Emerging Economies

Mehmet Gumus, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, mehmet.gumus@mcgill.ca, Sameer Mathur, Saibal Ray

Emerging markets (e.g. China, India) are gaining increasing economic importance. These markets are characterized by a significant proportion of middle class consumers with limited ability to pay for consumer packaged goods (CPG). In this paper, we investigate the impact of consumer's limited ability to pay for CPG products on intra-channel decisions between manufacturers and retailers as well as retailer's pricing and targeting strategies.

2 - When Gray Markets Have Silver Linings: All-unit Discounts, Gray Markets and Channel Management

Michael Pavlin, Assistant Professor, Wilfrid Laurier University, 75 University Avenue West, Waterloo, ON, Canada, Michael.Pavlin06@Rotman.Utoronto.Ca, Ming Hu, Mengze Shi

We study unauthorized distribution channels (gray markets) caused by a reseller's response to a supplier's all-unit quantity discount. We perform a closed-form analysis of the reseller's optimal pricing, inventory and gray market diversion decisions. We identify conditions where it is optimal for the profit-maximizing supplier to accommodate the gray market.

3 - Inventory Information Disclosure Tactics to Leverage Stock-out Risk

Tolga Aydinliyim, Lundquist College of Business, University of Oregon, Eugene, OR, 97403, United States of America, tolga@uoregon.edu, Elliot Rabinovich, Michael Pangburn, Min Choi

We investigate whether an online retailer should divulge its stocking level, or merely indicate availability via the "in stock" cue, while optimally pricing its product. We find, analytically, that disclosing accurate inventory information can mitigate strategic consumer behavior, and support this finding via an empirical study of two online retailers.

4 - Store Brand Introduction: Role of Uncertain Consumer Tastes and the Effects on Strategic Inventory

Arcan Nalca, Assistant Professor, Queen's School of Business, Queen's University, Kingston, Canada, arcan.nalca@business.queensu.ca, Tamer Boyaci, Saibal Ray

While developing store brands, retailers take advantage of their direct customer contact and generate private information about the liked and disliked features of existing brands. In this work, we investigate the optimal retail strategy to capitalize on the private information regarding the desired product characteristics in the context of store brand introduction. We also elaborate on the interaction between the store brand introduction and strategic inventory in a dynamic environment.

■ WC04

04- West 102 C- CC

Advances in Dynamic Programming and Control

Contributed Session

Chair: John Hedengren, Assistant Professor, Brigham Young University, 350 CB, Provo, UT, 84602, United States of America, john_hedengren@byu.edu

1 - Efficient Discretization in Stochastic Dynamic Programming Applied to Hydrothermal Systems

Rafael Brandi, PhD Student, Federal University of Juiz de Fora, Rua Josè LourenÁo Kelmer, 1015/301, Juiz de Fora, 36036330, Brazil, rafael.brandi@engenharia.ufjf.br, Tales Ramos, Joao Passos Filho, Andrè Marcato, Bruno Dias, Ivo Silva Junior

The Stochastic Dynamic Programming (SDP) can be utilized on long term operation planning of electrical power systems and it is essentially based on state space discretization. Thus, this work presents an algorithm where the states to be evaluated are determined in an iterative manner at each stage. The discretization is efficient because it is used more or less points rather than uniform distribution to compose regions of the cost-to-go function with a good approximation.

2 - Bayesian Process Control with Multiple Assignable Causes

Jue Wang, PhD Candidate, Department of Mechanical & Industrial Engineering,University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, juewang@mie.utoronto.ca, Chi-Guhn Lee

We investigate the structure of optimal policy for Bayesian process control with multiple assignable causes in the framework of POMDP. The objective is to find an optimal stopping time that maximizes the total expected reward in infinite horizon. A conditional control limit policy is found to be optimal. We derive the analytical bounds for the control regions and devise an algorithm to reduce the computation. The structural results also provide insights on choosing the optimal sampling interval.

3 - Shape Constrained Dynamic Programing

Mohammad Mousavi, Stanford University, 140 Ayrshire Farm Lane, Stanford, CA, 94305, United States of America, mousavi@stanford.edu, Peter Glynn

There is a wide range of dynamic programming problems in which it is known that value function satisfy a specific property such as convexity or log-concavity. In this work, we present a non-parametric method to estimate the value function of a dynamic programming problem using this property. We use value iteration and convex regression iteratively to project the value function to the space of convex functions.

4 - BPOPT: MINLP Solver for Differential Algebraic Systems with Benchmark Testing

John Hedengren, Assistant Professor, Brigham Young University, 350 CB, Provo, UT, 84602, United States of America, john_hedengren@byu.edu, Kody Powell, Wesley Cole, Thomas Edgar

Differential algebraic systems can lead to large-scale Mixed Integer Nonlinear Programming (MINLP) problems due to the discretization over a time horizon. A new solver, BPOPT, exploits a number of structural characteristics of these systems to solve optimization problems for real-time process control and scheduling applications.

5 - Global Control Optimization of Supercapacitor-Battery Electric Vehicles

Jeremy Michalek, Associate Professor, Carnegie Mellon University, Scaife Hall 324, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, jmichalek@cmu.edu, Orkun Karabasoglu

Integrating energy-dense batteries with power-dense supercapacitors in EVs can increase battery life. We globally optimize the control of supercapacitor-battery systems in EVs for real world driving conditions. We minimize key degradation factors: battery current squared and energy processed. We achieve 63% reductions in current-squared losses by employing a 50 Wh supercapacitor.

■ WC05

05- West 103 A- CC

Statistical Methods for Process Optimization

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, United States of America, paul.goethals@usma.edu

1 - Designing Damage Functions for Military Applications

Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, United States of America, paul.goethals@usma.edu, Timothy Griggs, Byung Rae Cho, Gregory Boylan

Over the last sixty years, a number of damage functions have been developed to appropriately model the effects of fragment dispersion. These functions may take into account several factors such as weapon accuracy, human error, and meteorological conditions, when applied to a particular targeting scenario in the military. This research examines the applicability of these functions and explores various alternatives by means of statistical modeling and optimization.

2 - Conditions-Based Approach to Regression Estimation in Robust Parameter Design

Gregory Boylan, Clemson University, Rm 150, Freeman Hall, Clemson, SC, United States of America, boylangc@earthlink.net, Byung Rae Cho

Typical robust design problems use least squares regression to determine optimal process settings by assuming normality and moderate variability in process outputs. In reality such conditions rarely hold, which can adversely affect results if ignored. This research examines alternative regression approaches to ascertain which estimators yield better solutions when high-variability and asymmetric conditions exist. Numerical studies and simulation facilitate comparison with traditional approaches.

■ WC06

06- West 103 B- CC

Simulation and Computational Modeling of Individual Behaviors

Sponsor: Simulation

Sponsored Session

Chair: Ozgur Araz, Assistant Professor, University of Nebraska Medical Center, Nebraska Medical Center, Omaha, NE, 68198-4365, United States of America, ozgur.araz@unmc.edu

1 - Modeling Service Operations: A Mixed Discrete-Event and Agent Based Simulation Approach

Stewart Robinson, Professor of Management Science, Loughborough University, School of Business and Economics, Loughborough, LE11 3TU, United Kingdom, S.L.Robinson@lboro.ac.uk

Discrete-event simulation, which has grown out of modeling manufacturing systems, has increasingly been applied in the service sector. The approach, however, is not always appropriate for modeling service operations; it cannot help with detailed decisions about the layout of services such as retail outlets and airports. A mixed discrete-event and agent based simulation approach is proposed for modeling such systems. The approach will be demonstrated through a simple model of a coffee shop.

2 - A Multiscale Paradigm Combining Individual-based Modeling and System Dynamics to Design Policy Options for Obesity

Özge Karanfil, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, United States of America, karanfil@mit.edu, Dean Hartley, Theresa Brown, Aldo Zagonel, Thomas Moore, Mihalis Golias

We present a multi-model paradigm integrating a community-scale individual-based model (IBM) to investigate the immediate effects of interventions with a population-scale system dynamics (SD) model to analyze long term results of those interventions. The IBM incorporates actors embedded in a social network to simulate the spread of opinions relating to nutrition and physical activity behaviors, and the effects of these opinions on individuals. We analyze and compare effects of possible policy interventions and illustrate a policy cocktail to address multiple aspects of obesity.

3 - Mitigating Infectious Disease Outbreaks in Medical Facilities with Incomplete Vaccination

Thomas Moore, Complexity Scientist, Sandia National Labs, MS 1138, Albuquerque, NM, United States of America, tmoore@sandia.gov, Patrick Finley, Richard Martinello, Carter Mecher, Katherine Jones, Victoria Davey

Health care facilities are vulnerable to outbreaks of contagious disease. Managing outbreaks in facilities relies on identifying transmission pathways and limiting new infections. Interventions include targeted vaccination and staff furloughs, but these are complicated by incomplete information about staff susceptibility and vaccine refusal. We model the spread of Varicella and analyze the impact of staffing policy and vaccination programs on the affected facility and on surrounding facilities.

4 - Social Network Modeling for Understanding Food Culture

Ozgur Araz, Assistant Professor, University of Nebraska Medical Center, Nebraska Medical Center, Omaha, NE, 68198-4365, United States of America, ozgur.araz@unmc.edu, Terry Huang

Existing body of literature for understanding the influence of social networks on food consumption behaviors is limited in terms of taking the cultural influences and values into consideration. We built an agent based model to explore two different types of social networks for analyzing the impact of individuals' social relations on food values and culture. These weighing of different ties in individuals' network allow our research to explore social network characteristics more adequately.

■ WC07

07- West 104 A- CC

Discovering Complex Anomalous Patterns

Sponsor: Data Mining

Sponsored Session

Chair: Artur Dubrawski, Director, Auton Lab, Carnegie Mellon University, 5000 Forbes Avenue NSH 3121, Pittsburgh, PA, United States of America, awd@cs.cmu.edu

1 - Retrieval of Simple and Informative Views of Complex Data

Madalina Fiterau, Carnegie Mellon University, 5000 Forbes Ave., 6105 Gates-Hillman Complex, Pittsburgh, PA, 15213, United States of America, mfiterau@cs.cmu.edu, Artur Dubrawski

Data driven analyses involving human interpretation benefit from models that are comprehensible as well as accurate. Consider a radiation threat detection system which leverages high dimensional measurements to determine if a truck carries radioactive cargo. Predictions on such data must be supported with intuitive explanations to allow border inspectors to make confident decisions. We present algorithms that produce informative views of data and support explainability of automated predictions.

2 - Systematic Explanation of Differences across a Pair of Datasets

Yuriy Sverchkov, Graduate Student Researcher, University of Pittsburgh, 200 Meyran Ave., Parkvale Building Suite M-183, #M-192, Pittsburgh, PA, 15260, United States of America, yus24@pitt.edu, Gregory Cooper

We describe a method for obtaining a concise and mathematically grounded description of multivariate differences across a pair of datasets. Often data collected under similar circumstances reflect different patterns, e.g., patients undergoing similar treatments in distinct hospitals may experience different outcomes. We use a Bayesian network learned from the data to identify the subgroups of records that contribute to such observed differences, and qualify and quantify these contributions.

3 - Fast Graph Structure Learning from Unlabeled Data for Event Detection

Sriram Somanchi, PhD Student, Carnegie Mellon University, 4800 Forbes Avenue, Heinz College, Pittsburgh, PA, 15213, United States of America, somanchi@cmu.edu, Daniel Neill

Processes such as disease propagation often spread over some latent network structure which must be learned from observation. We propose a new framework for learning graph structure from unlabeled data by comparing the most anomalous subsets detected with and without the graph constraints. Using simulated disease outbreaks injected into real-world hospital data, we show that our method learns a structure similar to the true underlying graph, but enables faster and more accurate detection.

4 - Generative Models for Detecting Distributional Anomalies

Liang Xiong, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, lxiong@cs.cmu.edu, Barnabas Poczsos, Jeff Schneider

In many scientific data sets, an anomalous phenomenon emerges not as an individual datum but as a pattern that consists of multiple objects. In this talk we describe how to detect anomalous patterns that are characterized by the distribution of the group of objects. Based on the topic modeling technique, we develop generative models that are suited to this task. The effectiveness of this approach is verified by experiments on images, turbulence simulation, and astronomical spectra.

■ WC08

08- West 104 B- CC

Joint Session SPPSN/MAS: Law Enforcement and Homeland Security I

Sponsor: Public Programs, Service and Needs & Military Applications

Sponsored Session

Chair: John Hollywood, Operations Researcher, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States of America, johnsh@rand.org

1 - Listening to the Field: Law Enforcement Needs for the OR Community

John Hollywood, Operations Researcher, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States of America, johnsh@rand.org

We present the results of recent studies on law enforcement's needs for new technologies, including needs for OR analysis. We discuss how these needs are very different from "traditional" OR for policing, reflective how policing philosophies are changing from focusing on crime response to crime prevention.

2 - Urban Area Crime Modeling: Spatiotemporal History, Opportunity, and Security Resource Allocation

Daniel Salazar, University of Southern California, 3710 McClintock Ave., Los Angeles, CA, 90089-2902, United States of America, danielsalazaraponte@gmail.com, Samrat Chatterjee

We present a probabilistic graphical model based approach to estimate the risk of robbery around a university campus. Model components include location and time of past incidents, opportunity related to pedestrian density and environmental conditions -like weather and lighting- as well as mobile preventative security resources. Optimization models for allocation of mobile security measures to reduce robbery risk are also discussed.

3 - An Interactive Simulation Model for Evaluating the Performance of Port Security Screening Policies

Carrie Phillips, North Carolina A&T State University, 5936 N Church St., Greensboro, NC, 27455, United States of America, caphill2@aggies.ncat.edu, Xiuli Qu, Lauren Davis

Port security has been a significant part of homeland security since 9/11. Effective port security screening policies are needed to reduce the risk from potential threats and ensure port productivity. An interactive simulation model is constructed for port policy makers to compare alternative screening policies. The model integrates disruptions from multiple threats such as terrorist attack, bombs, and hijacking. An experiment is carried to identify better port security screening strategies.

■ WC09

09- West 105 A- CC

Combinatorial Multi-Objective Optimization

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Ozgur Ozpeynirci, Izmir University of Economics, Sakarya Cad. No:156, Izmir, 35330, Turkey, ozgur.ozpeynirci@ieu.edu.tr

1 - Conic Scalarization for Multi Objective Quadratic Assignment Problems

Zehra Kamisli Öztürk, Assistant Professor, Anadou University, Engineering Faculty, Industrial Engineering Department, Eskisehir, 26555, Turkey, zehrakozturk@gmail.com

The multi objective quadratic assignment problem (mQAP) is an non-deterministic polynomial-time complete (NPC) problem with many real-world applications. In this work, we consider to compare the quality of solution sets generated by the conic scalarization technique and a multi objective genetic algorithm of NSGA-II for various mQAP test problems.

2 - Multiobjective Order Picking Problem

Cansu Kandemir, PhD Student, Old Dominion University, Department of Engineering Management, Norfolk, VA, 23529, United States of America, ckand002@odu.edu, Ozgur Ozpeynirci

We work on the order picking problem (OPP) in a special warehouse with one picker. The single objective version of this problem is polynomially solvable. We address the multiobjective version and show that the algorithm designed for single objective OPP is not capable of finding all nondominated points. After analyzing the properties of nondominated points, we develop a pseudo-polynomial algorithm to find a nondominated point. We propose an approach to generate all nondominated points.

3 - Workload Balancing Problem for Nurses: A Multi-Objective Approach

Ilgin Poyraz Acar, Anadolu University, Department of Industrial Engineering, Anadolu University, Eskisehir, Turkey, ipoyraz@anadolu.edu.tr, Aydin Sipahioglu, Steven E. Butt

In addition to using patient acuity measures, this work considers incorporating travel distances into the construction of a nurse's patient assignments based on the use of unit-derived workload scores and distance scores. It is shown that the conic scalarization approach can be successfully used for solving these multi-objective nurse-to-patient assignment problems.

4 - Biobjective Pharmacy Duty Scheduling Problem

Ozgur Ozpeynirci, Izmir University of Economics, Sakarya Cad. No:156, Izmir, 35330, Turkey, ozgur.ozpeynirci@ieu.edu.tr

In Turkey, only on duty pharmacies provide service at the nights of weekdays and at the weekends. The pharmacy duty scheduling (PDS) problem assigns duties to the pharmacies to provide the best possible service to the public. PDS is a special multi-period facility location problem and it is NP-Hard. In this study, we propose the secondary objective that balances the workloads of the pharmacies. The study is supported by the Scientific and Technological Council of Turkey (TUBITAK).

■ WC10

10- West 105 B- CC

Computation and Adaptation in Stochastic Regimes with Limited Information

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Uday Shanbhag, University of Illinois at Urbana-Champaign, 206 Transportation Building, Urbana, IL, United States of America, udaybag@illinois.edu

1 - Distributed Optimization and Learning under Partial Observations

Ali Sayed, Professor, University of California, Department of Electrical Engineering, University of California, Los Angeles, CA, 90095, United States of America, sayed@ee.ucla.edu, Jianshu Chen

We study the distributed optimization of a global cost function over a network of nodes. We examine the situation in which the information observed by each node is insufficient for the node to solve the problem independently. Diffusion adaptation strategies are employed to allow the incomplete information at each node to flow across the entire network through local interactions and in-network processing. We analyze the performance and convergence of the distributed solution.

2 - Averaging, Sampling, and Derivative Estimation within Stochastic Approximation Algorithms

Raghu Pasupathy, Associate Professor, Virginia Tech, Blacksburg, VA, 24060, United States of America, pasupath@vt.edu, Fatemeh Hashemi

Despite stochastic approximation algorithms' enduring popularity for continuous simulation optimization, the prevailing opinion is that their finite-time performance can sometimes be poor. In a further attempt at alleviating this, we combine several ideas —- dynamic steps, Polyak-Ruppert averaging, and sampling —- within the iterative process. We characterize the resulting rates and discuss implementation.

3 - On the Convergence of Joint Schemes for Online Computation and Supervised Learning

Hao Jiang, UIUC, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, jiang23@illinois.edu, Uday Shanbhag

We consider the development of joint schemes for learning and computation in the context of parametrized variational inequalities where the unknown parameter is learned through observations. Such a learning scheme is interlaced with a first-order gradient update method. We provide probabilistic convergence guarantees that ensure that the resulting sequences of parameters and iterates converge to their true counterparts under varying assumptions.

4 - Comparing Stochastic and Deterministic Models for Inventory Problems

William Cooper, University of Minnesota, 111 Church St. SE, Minneapolis, MN, United States of America, billcoop@me.umn.edu

We consider inventory problems with unknown demand distributions, and we compare the performance of stochastic and deterministic models for selecting order quantities when the parameters of the models are estimated from data. The goal is to identify when the stochastic model outperforms the deterministic model and vice versa.

■ WC11

11- West 105 C- CC

Theoretical Non-linear Optimization

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Emre Tokgoz, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73071, United States of America, Emre.Tokgoz-1@ou.edu

1 - Theoretical Results to Solve Unconstrained Non-linear Mixed Integer Programming Problems

Emre Tokgoz, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73071, United States of America, Emre.Tokgoz-1@ou.edu

In the literature of mixed integer programming there are not many known theoretical results to solve unconstrained non-linear mixed integer programming problems. In this talk, I will be presenting theoretical results that I obtained to solve unconstrained non-linear mixed integer programming problems for several classes of mixed (i.e. discrete and continuous) variable functions. In addition, I will have suggestions to improve the existing results.

2 - An Active-set Approach using a Primal-dual Augmented Lagrangian for Large-scale Nonconvex Optimization in SAS

Wenwen Zhou, SAS Institute, Inc., Cary, NC, United States of America, Wenwen.Zhou@sas.com

SAS has recently developed and implemented multi-threaded Krylov-based interior-point and active set methods for large-scale nonconvex optimization. Both methods use the exact primal dual augmented Lagrangian merit function of P. E. Gill and D. Robinson. In this talk we focus on the active-set approach and will give some numerical results to demonstrate nice features about this approach and discuss some strategies used for improving convergence.

3 - An Interior-point Approach using a Primal-dual Augmented Lagrangian for Large-scale Nonconvex Optimization in SAS

Joshua Griffin, SAS Institute, Inc., Cary, NC, United States of America, jdgriffi@gmail.com

SAS has recently developed and implemented multi-threaded Krylov-based interior-point and active set methods for large-scale nonconvex optimization. Both methods use the exact primal dual augmented Lagrangian merit function of P. E. Gill and D. Robinson. In this talk we focus on the interior-point approach and will give some numerical results to demonstrate nice features about this approach and discuss some strategies used for improving convergence.

■ WC12

12- West 106 A- CC

Binary Representations in Mixed Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Akshay Gupte, Assistant Professor, Clemson University, Martin Hall, Clemson, SC, United States of America, agupte3@isye.gatech.edu

1 - Modeling Disjunctions of Polytopes, with Applications to Piecewise-Linear Functions

Warren Adams, Clemson University, O-327 Martin Hall, Clemson, SC, 29634, United States of America, Wadams@clemson.edu, Frank Muldoon

We model the convex hull of the union of a collection of polytopes using a logarithmic number of binary variables. For special structures, we show how projections can lead to concise forms. These structures include knapsack constraints and SOS-d restrictions. The SOS-2 case allows for the handling of piecewise-linear functions, yielding new representations and motivating existing ones. Favorable computational experience is reported.

2 - Improved Optimality Cuts for the Integer L-shaped Method

Gustavo Angulo, 922 Myrtle St NE, Atlanta, GA, 30309, United States of America, gangulo@gatech.edu, Shabbir Ahmed, Santanu Dey

We propose an approach to improve the optimality cuts generated by the integer L-shaped method. While the original implementation only uses local information of the solution to be cut off, our approach generates optimality cuts based on the information provided by all feasible solutions visited so far at a given step of the method. In developing this approach, we prove the tractability of describing the convex hull of all binary vectors except a list of forbidden vectors.

3 - On Bounded Mixed Integer Bilinear Terms

Akshay Gupte, Assistant Professor, Clemson University, Martin Hall, Clemson, SC, United States of America, agupte3@isye.gatech.edu, Shabbir Ahmed, Santanu Dey

We consider a single bounded bilinear term written as a product of two bounded variables, both integer or one continous and one integer. Binary representation of one integer variable produces a mixed integer linear set in an extended space. We show different ways of obtaining valid inequalities for this set using knapsack covers and polymatroids of a submodular function.

4 - On Convexification of Problems with Signomial Functions by Mixed Integer Programming

Andriy Shapoval, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, United States of America, ashapoval3@gatech.edu, Eva Lee

This work continues our previous research in convexification and underestimation techniques for structured mixed integer nonlinear programs with using conflict graphs and hypergraphs. The mixed hyperedge method, introduced for problems with posynomials before, is extended and applied now for problems with signomial terms. New facet-defining inequalities together with their separation are presented.

■ WC13

13- West 106 B- CC

Integer Programming Applications

Contributed Session

Chair: Zhichao Zheng, PhD Candidate, National University of Singapore, 1 Business Link, Biz 2 Building, #B2-03, Singapore, 117592, Singapore, zhichao@nus.edu.sg

1 - Network Data Contamination Detection with Artificial Neural Networks

Seyedamirabbas Mousavian, Research Assistant, PhD Student, Auburn University, 3331 Shelby Center of Engineering, Auburn University, Auburn, AL, 36849, United States of America, szm0032@auburn.edu, Jorge Valenzuela, Jianhui Wang

In this paper, we show the risks associated with cyber attacks and propose an artificial neural network-based protection approach. The proposed algorithm can monitor the output of power flow calculations and detect data anomalies in real-time. The network observability rules are formulated as a mixed integer linear program (MILP) problem to decrease the amount of data input required by the algorithm while the system stays observable.

2 - Effective Methods for Solving the View Selection Problem in Database Management Systems

Rong Huang, Research Assistant, North Carolina State University, 484 Daniels Hall, Raleigh, NC, 27695, United States of America, rhuang@ncsu.edu, Rada Chirkova, Yahya Fathi

We introduce the concept of "cost-benefit ratio" in the context of the view selection problem in database management systems, and discuss its properties. We then employ this concept in the context of an integer programming model for the view selection problem and demonstrate its effectiveness through a computational study.

3 - A Centrality Concept and Application in Biological Network

Seyed Javad Sajjadi, University of South Florida, 4202 Fowler Ave., Tampa, FL, United States of America, ssajjadi@mail.usf.edu, Bo Zeng, Xiaoning Qian

A novel approach is introduced to identify the most important nodes in a given network. We present a new measure of group centrality and obtain a subset of nodes that removal of which, decreases the centrality the most. To obtain such a subset we solve an integer programing model.

4 - Least Squares Approximation to Stochastic Mixed Zero-One Linear Optimization Problem

Zhichao Zheng, PhD Candidate, National University of Singapore, 1 Business Link, Biz 2 Building, #B2-03, Singapore, 117592, Singapore, zhichao@nus.edu.sg, Chung Piaw Teo, Karthik Natarajan

We consider a mixed 0-1 LP problem with random objective coefficients following a multivariate normal distribution, and develop an approach to approximate the distribution of its optimal value. Linking our model to the classical Stein's Identity, we show that the least squares normal approximation can be computed by solving the persistency problem. We extend our model to quadratic least squares estimator and report extensive computational results to demonstrate the advantages of our approach.

5 - Heuristic Optimization Model of Credit Risk Mitigation Tool Ordering

Hao Fu, Vassar College, 124 Raymond Avenue, Box 2555, Poughkeepsie, NY, 12604, United States of America, markfu1022@gmail.com

Under the global regulatory framework Basel III, the credit risk mitigation (CRM) tools used by banks correspond to different amounts of risk-weighted assets. We establish the matching model between CRMs and facilities and explore the optimal ordering of CRMs in order to maximize the mitigation effect. Genetic algorithm is applied to solve the optimization problem.

■ WC17

17- West 208 B- CC

Strategies in Education

Contributed Session

Chair: Rick Hesse, Professor, Pepperdine University, 1174 Westridge Drive, Ventura, CA, 93003, United States of America, rhesse@Pepperdine.edu

1 - Strategies for Climbing in University Rankings

Jose Dula, Virginia Commonweatlth University, 301 W Main St., Richmond, VA, United States of America, jdula@vcu.edu, Marie-Laure Bougnol

Accepting the premise that rankings are here to stay and that administrators wish to see their institutions rise in these rankings, the question becomes: is there an optimal strategy for achieving higher rankings? In this paper we treat the problem of climbing in rankings as a mathematical model the solution to which leads to an optimal strategy.

2 - Overcoming Learning Bottleneck

Anita Lee-Post, Associate Professor, University of Kentucky, 425 Gatton Bldg, Lexington, KY, 40506, United States of America, dsianita@uky.edu

We present an innovative approach to overcome challenges in learning and training. The approach is grounded in theory of constraints following the decoding the discipline model. A cognitive bottleneck involving quantitative modeling and an affective bottleneck concerning low self-efficacy of quantitative literacy are investigated. Specific interventions are designed to address the specific bottlenecks. The effectiveness of the interventions in overcoming these learning bottlenecks is reported.

3 - E2B Projects for Decision Sciences MBA Courses: Opportunity & Challenges

Rick Hesse, Professor, Pepperdine University, 1174 Westridge Drive, Ventura, CA, 93003, United States of America, rhesse@Pepperdine.edu, Samuel Seaman, Doreen Shanahan, Joe Hahn

The Education to Business model that has worked successfully for MBA Marketing courses has been extended on trial basis to Decision Science courses. Three successful experiences are explained.

■ WC18

18- West 208 A- CC

Optimization Methodologies: Polynomial and Other Problems

Contributed Session

Chair: Vijay Ramalingam,Graduate Student, The University of Mississippi, 303, Brevard Hall, The University of Mississippi, University, MS, 38677, United States of America, vramalingam@bus.olemiss.edu

1 - Tightening the Sum of Squares Representation of a Polynomial Optimization Problem

Timothy Lee, Graduate Student, Rensselaer Polytechnic Institute, Mathematical Science, Troy, NY, United States of America, leet3@rpi.edu, John Mitchell

A sufficient condition that a polynomial be nonnegative is that it is representable as a Sum-of-Squares(SOS). SOS representability can be determined by solving a semidefinite program. We describe extensions to the SDP formulation that can be used to determine non negativity for certain polynomials that are not SOS representable. These extensions exploit the arithmetic/geometric mean inequality and can be represented as linear constraints in the dual to the SDP formulation.

2 - Complex Valued Polynomial Optimization

Bo Jiang, University of Minnesota, MN, United States of America, jiang373@umn.edu, Shuzhong Zhang

In this talk we will present a study on the design of radar waveforms sharing a desired ambiguity function using quartic polynomial optimization formulation in complex variables. We propose solution methods including the so-called Maximum Block Improvement method and Alternating Direction Method of Multipliers. Convergence properties of the solution methods will be discussed. Finally we evaluate the performance of the proposed techniques by presenting the results of our numerical experiments.

3 - Random Oscillation Based Selection in Hopfield Network for Maximum Diversity Problems

Vijay Ramalingam, Graduate Student, The University of Mississippi, 303, Brevard Hall, The University of Mississippi, University, MS, 38677, United States of America, vramalingam@bus.olemiss.edu, Bahram Alidaee

This paper presents a random oscillation based selection method in discrete Hopfield neural network for maximum diversity problems. The method relies on number of neutrons to fire and this number alternates above and below the feasible number. At each iteration a feasible set is selected to compute objective function, but an infeasible set is passed to the next iteration as input. The algorithm procedure and the results from solving benchmark problems will be discussed.

4 - Minty Variational Principle in Set Optimization

Giovanni Crespi, Professor, University of Valle d'Aosta, Loc. Grand Chemin 73/75, Saint Christophe, Italy, g.crespi@univda.it, Carola Schrage, Andreas H Hamel

We extend the Minty variational principle to set optimization, to give sufficient conditions for non dominated elements. We use a new approach to the definition of a differential type variational inequality associated to a set-valued function. To this extent a Dini derivative for set-valued functions is introduced, convexity and monotonicity are discussed by means of scalarization.

■ WC19

19- West 211 A- CC

Operations Research for Public Health

Cluster: INFORMS/SMDM Applications Joint Cluster

Invited Session

Chair: Margaret Brandeau, Stanford University, Huang Engineering Center, Stanford, CA, 94305, United States of America, brandeau@stanford.edu

Co-Chair: James Stahl, Massachusetts General Hospital, Boston, MA, United States of America, jstahl@mgh-ita.org

1 - Forging Successful INFORMS/SMDM Collaborations

Douglas Owens, VA/Stanford, 117 Encina Commons, Stanford, CA, 94305-6019, United States of America, owens@stanford.edu, Margaret Brandeau

This talk describes examples of successful collaborations between INFORMS members and SMDM members in the area of operations research applied to public health. We also identify key aspects of successful collaboration, and suggest a road map for future joint work.

2 - Discrete Event Simulation of a Comprehensive Care Physicians (CCP) Model

David Meltzer, University of Chicago, 5841 S Maryland Avenue, MC 5000, Chicago, IL, 60637, United States of America dmeltzer@medicine.bsd.uchicago.edu, Tom Best

The Centers for Medicare and Medicaid Innovation (CMMI) has recently completed the first round of funding for their Innovation Challenge Awards that seek to address the triple aim of improved care, reduced costs, and improved population health. The University of Chicago and set of Chicago-area partners received an award under this program to test a new model of care in which patients at high risk of hospitalization receive care from comprehensive care physicians (CCPs) - physicians who care for patients at high risk of hospitalization both in the inpatient and outpatient setting. The model is based on an understanding of the historical forces that led to the development of the hospitalist model in the United States and the advantages and disadvantages of that model. This analysis suggests that, while experienced hospitalists can produce some improvements in costs and outcomes, practical considerations of declining inpatient relative to outpatient patient volume were a major driver of the growth of hospitalists. Moreover, a major disadvantage of the hospitalist model, especially for frequently hospitalized patients, is the loss of the value of the doctor-patient relationship that can occur when patients are hospitalized. The CCP model addresses this concern by focusing the practices of these physician on a very small number of patients (approximately 250 per physician) at increased risk of hospitalization, so that the physician can care for these patients in both the inpatient and outpatient setting, taking primary personal responsibility for directing the care of a multidisciplinary team tailored to the needs of individual patients. To design the CCP Program , including issues such as patient selection and physician scheduling, we built a discrete event simulation model. The construction of the model provided valuable quantitative insights into the potential functioning of the CCP program, but also provided qualitative insights that were highly valuable.

3 - INFORMS/HAS Collaboration with SMDM
Michael Carter, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, mike.carter@utoronto.ca

I will discuss my impressions of the overlap and the opportunities between the Health Applications Section and SMDM.

4 - The Need for (long) Chains in Kidney Exchange
Itai Ashlagi, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E62-577, Cambridge, MA, 02139, United States of America, iashlagi@mit.edu

We explore both empirically and theoretically the benefit of long chains in kidney exchange. We show that long chains can significantly increase eefficiency when opportunities for exchange are sparse. As large cycles of exchange cannot be used in practice, long chains initiated by non-directed donors significantly increase eefficiency in pools of the size and composition in practice. Importantly, long chains benefit highly sensitized patients without harming low-sensitized patients.

■ WC20

20- West 211 B- CC

Implementing OR/IE/MDM in Practice

Cluster: INFORMS/SMDM Applications Joint Cluster

Invited Session

Chair: Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue (MC258), Urbana, IL, 61801, United States of America, shj@illinois.edu

Co-Chair: Dominick Frosch, Palo Alto Medical Foundation, Palo Alto, CA, United States of America, froschd@pamfri.org

1 - Quick-and-dirty Success Stories of OR in Healthcare
Murray Côté, Associate Professor, Texas A&M Health Science Center, 1266 TAMU, 368D SRPH Administration Building, College Station, TX, 77843-1266, United States of America, mjcote@srph.tamhsc.edu, Tiffany Radcliff

A perennial concern within our discipline is convicing healthcare stakeholders that our tools and recommendations have merit. This presentation will provide several successful, albeit not-too-technical, applications along with some lessons for managing the academic/pracitioner relationship.

2 - Road Blocks to the Adoption of Patient Decision Support
Glyn Elwyn, Professor, The Dartmouth Center for Healthcare Delivery Science, 37 Dewey Field Road, 2nd Floor, Dartmouth Center for Healthcare Delivery, Hanover, NH, 03755, United States of America, glynelwyn@gmail.com

Two decades of work has shown the positive impact of patient-targeted decision support interventions. Yet, despite demonstrated efficacy, their effectiveness in routine clinical practice has yet to be established. We reviewed existing feasibility studies and found evidence of significant challenges to implementation, including professional indifference, a lack of confidence in their content and disruption to established work flows, all of which contributed to organizational inertia.

3 - Predictive Analytics for Solid Organ Transplant Operations
Diwakar Gupta, University of Minnesota, 111 Church Street S. E., Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu

Operations Research professionals have much to contribute to the policy debate concerning how best to prioritize allocation of organs to wait list candidates. This talk will present efforts to improve Simulated Allocation Models (SAMs), which are simulation based predictive modeling tools, for the purpose of policy evaluation and policy development.

4 - Personalized Decision Support in The University of California Athena Breast Health Network
Elissa Ozanne, UCSF Medical Center, 3333 California St., Suite 265, San Francisco, CA, 94118, United States of America, elissa.ozanne@ucsfmedctr.org, Laura Esserman, Beth Crawford

The Athena Breast Health Network is an innovative collaboration across the five University of California medical centers. In Athena, clinical care and research are integrated - allowing data collection, broad data access, and continuous feedback to inform and drive research and improvement in care. Athena launched with a screening and prevention initiative, which automates risk assessment and decision support for all women who receive a mammogram and complete an electronic health questionnaire.

■ WC21

21- West 212 A- CC

Network Interdiction

Sponsor: Optimization/Networks

Sponsored Session

Chair: Steffen Rebennack, Assistant Professor of Operations Research, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, srebenna@mines.edu

Co-Chair: Greg Steeger, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, United States of America, gsteeger@mymail.mines.edu

1 - Game-theoretic Network Interdiction: Heterogeneous Searchers
R. Kevin Wood, Distinguished Professor, Operations Research Department, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, kwood@nps.edu, Alan Washburn, Lee Ewing

A two-person zero-sum game models an interdictor who must allocate heterogeneous searchers to maximize the probability of detecting an evader moving through a network. We first solve an LP for an optimal "marginal strategy" for the interdictor, and then efficiently derive a valid mixed strategy from that: a polynomial-time, overall solution results. When assumptions must be relaxed, dynamic row and column generation solve the problem.

2 - A Cutting-Plane Method for Two Facility Reliability Problems
Mike Prince, Graduate Research Assistant, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, mikeprince4@ufl.edu, J. Cole Smith

We analyze two three-stage problems in which an operator makes system fortification decisions in the first stage and in the second stage, disruptions occur. In the third stage, the operator assigns demand nodes to facilities with a goal of either minimizing the total weighted demand or minimizing the maximum distance between any demand and its assigned facility. We develop various formulations for these models and develop a cutting-plane method for their solution.

3 - On the Critical Node Detection Problem
Ashwin Arulselvan, TU Berlin, Strasse Des 17 Juni, Berlin, Germany, arulsel@math.tu-berlin.de

We are given a graph G(V,E) and integer k. We seek a set of k nodes whose deletion results in maximum fragmentation of the graph. We study several variants of this node deletion problem and present the techniques studied to solve the problem.

4 - Network Interdiction via a Critical Disruption Path
Greg Steeger, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, United States of America, gsteeger@mymail.mines.edu, Steffen Rebennack, Donatella Granata

Network interdiction models inhibit network operations through impeding the network's connectivity, e.g. by deleting nodes or arcs in the network. In our case, we remove the path that minimizes the number of nodes in the largest connected component. This we term the Critical Disruption Path (CDP). We develop a tailored Branch and Price algorithm to solve large problems more efficiently than standard algorithms.

■ WC22

22- West 212 B- CC

Optimizing Power System Operation

Sponsor: Computing Society

Sponsored Session

Chair: Kathryn Schumacher, PhD Candidate, University of Michigan, Industrial & Operations Eng. Department, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, kaschu@umich.edu

1 - Wind Power Bidding with Chance Constraints
Jianhui Wang, Argonne National Laboratory, Argonne National Laboratory, Lemont, IL, 60439, United States of America, jianhui.wang@anl.gov, Qianfan Wang, Yongpei Guan

An optimal wind power bidding strategy with chance constraints will be presented in this talk. The chance constraints are used to enforce that a certain percentage of wind power be utilized. The problem is solved through Sample Average Approximation (SAA).

2 - Symmetry in the Unit Commitment Problem
James Ostrowski, University of Tennessee, 1425 S Stadium Dr, Knoxville, TN, 37996, United States of America, jostrows@utk.edu, Jianhui Wang

Adding symmetry-breaking to a highly symmetric instance of a MILP problem can reduce the size of the problem's feasible region. The same can be said for good dominance constraints. In this talk we will examine the impact of using dominance arguments to strengthen symmetry breaking constraints for the Unit Commitment (UC) problem. Symmetry is present in the UC problem when there are several generators of the same type.

3 - Algorithm to Solve N-k Secure Unit Commitment Problem with Transmission Switching
Kathryn Schumacher, PhD Candidate, University of Michigan, Industrial & Operations Eng. Department, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, kaschu@umich.edu, Amy Cohn, Richard Chen

We consider the unit commitment problem subject to the requirement that a certain threshold of consumer demand must be met in the event that any k or fewer elements simultaneously fail. Additionally, when a disruption occurs, the network operators have the option to switch out of service any transmission elements to help direct flows. We present an algorithm that can solve this problem and analyze the algorithmic performance.

4 - Capacity Guarantees as a Mechanism for Smart-grid Evolution
Xiaoyue Jiang, Tulane University, 7 McAlister Drive, New Orleans, LA, 70118, United States of America, xjiang@tulane.edu, Burcu Tan, Geoffrey Parker, Anjali Sheffrin, Ekundayo Shittu

We believe the economic framework of capacity guarantees together with new methodologies to evaluate capacity can play a vital role in delivering on the promise of smart grids. We show how these new tools can coordinate multiple technologies including renewables, storage integration, and demand response, to reshape the electricity and capacity market structure, and to create market incentives to evolve the power system in a more reliable, efficient and sustainable direction.

■ WC23

23- West 212 C- CC

Patient-Centered IT in Health Care

Contributed Session

Chair: Jennifer Percival, Associate Professor, UOIT, Faculty of Business and IT, 2000 Simcoe Street N, Oshawa, ON, L1H4K7, Canada, jennifer.percival@uoit.ca

1 - Study of Structured e-Visits: Analysis of Early Adoption
Changmi Jung, Doctoral Student, Carnegie Mellon University, 4800 Forbes Ave., Room 3009, Pittsburgh, PA, 15213, United States of America, changmi@cmu.edu, Rema Padman

The growing interest in online medical consultation, or eVisit, is attributed to immediacy of care, affordable cost, convenience, and efficient/flexible time management opportunities. In this study, we analyze the key features that distinguish early adopters of the service from patient portal consumers using data from a major healthcare provider in Western Pennsylvania. In particular, we conduct survival analysis and test innovation diffusion theory on eVisit employing the real usage data.

2 - Effect of Home Telemonitoring on Transitions between Frailty States and Death for Older Adults
Benjavan Upatising, PhD Candidate, Purdue University/Mayo Clinic, 200 1st Street SW, Rochester, MN, 55905, United States of America, benjavan@purdue.edu, Young L. Kim, Gregory J. Hanson, Yuehwern Yih, Paul Y. Takahashi

We evaluate if home telemonitoring impacts the functional decline in older adults. Participants were over 60 and had high risk of hospitalization and ED visits. We randomized 205 participants into telemonitoring (TELE) or usual care (UC) group. The primary outcome of worsening frailty status measured at 6 and 12 months. The results of the multiple logistics analysis indicated insufficient evidence that TELE does better than UC in slowing the decline of frailty states and death over 12 months.

3 - Social Networking, Measuring Traffic, and Branding in the Design Experience
Khalia Braswell, Undergraduate Research Scholar, North Carolina State University, 1860 Scholar Circle, Raleigh, NC, 27603, United States of America, khalia.braswell@gmail.com, Jeremy Currence, Kamar Galloway

In developing a website for African-American women that advocates prevention and awareness for HIV/AIDS, three things are important to consider: social media integration, tracking the social mushroom, and branding the user experience. As three research scholars, we use a participatory design process to pinpoint the specific health needs of the African-American female community.

4 - Integrating Information Systems into PaJMa to Support the Integration of e-Health Systems
Jennifer Percival, Associate Professor, UOIT, Faculty of Business and IT, 2000 Simcoe Street N, Oshawa, ON, L1H4K7, Canada, jennifer.percival@uoit.ca, Carolyn McGregor, Mike McCabe

This paper presents a revision of the Patient Journey Modeling Architecture (PaJMa) which includes a technology and infrastructure layer to visually depict how EHR can benefit patient care through improved information flows enabled by the integration of technology and clinical practice. Preliminary evaluation of the PaJMa modeling approach has shown increased clinic staff understanding of their processes, roles, and responsibilities as well as a higher degree of engagement in the change process.

5 - Model Analysis of Post Traumatic Stress Disorder Screening Policies
Hande Musdal, Graduate Research Assistant, Northeastern University, 360 Huntington Ave., 334 Snell Engineering Center, Boston, MA, 02120, United States of America, musdal.h@husky.neu.edu, Bradley Watts, Brian Shiner, James Benneyan

Screening and detection of post traumatic stress disorder (PTSD) is a major concern among veterans and the general public, with an estimated 15% incidence among OEF/OIF veterans, social costs of $923 million, and health consequences including long-term depression and suicide. We describe recent work to develop probability and economic models of current and proposed screening policies within the U.S. veteran and military health systems. Preliminary results and policy implications are discussed.

■ WC25

25- West 213 B- CC

Health Engineering Applications

Sponsor: Health Applications Society

Sponsored Session

Chair: Rene Villalobos, Arizona State University, 699 Mill Avenue, Tempe, AZ, 85281, United States of America, rene.villalobos@asu.edu

1 - Deployment of Food Desert Remedies in Urban Areas
Christopher Wishon, Arizona State University, Tempe, AZ, United States of America, Christopher.Wishon@asu.edu, Nicholas Mason, Rene Villalobos

The existence of urban food deserts, areas with limited access to healthy and affordable food, and their relationship to obesity rates is an ongoing debate. Some remedies to food deserts include opening new supermarkets, introducing farmers markets, or starting urban farm trucks (a commercial vehicle selling fresh foods). This research seeks to identify a method to determine which remedy to employ based on the region with respect to costs, potential health benefits, and environmental factors.

2 - Balancing Investment in FQHCs and Medicaid for Improved Access and Coverage
Paul Griffin, Professor and Head, Pennsylvania State University, Department of Industrial Engineering, University Park, PA, 16802, United States of America, pmg14@engr.psu.edu, Hyunji Lee, Christina Scherrer

The objective of this study is to find a balanced investment between CHC expansion and relaxing Medicaid eligibility to improve both access and coverage. The comparison is achieved by integrating mathematical models with several data sets that allow for specific estimations of healthcare need. We use the state of Pennsylvania as a test case. Our results have implications for policymakers on how increasing access or increasing coverage affect primary care.

3 - A Markov Model to Predict and Evaluate Dental Care
Iris Yan, Pennsylvania State University, Department of Industrial Engineering, University Park, PA, 16802, United States of America, rxy127@psu.edu, Paul Griffin, Susan Griffin

Children with dental insurance will increase by 36% in 2014. We use Medical Expenditure Panel Survey data from 2008 to 2009 to predict increased dental utilization and to examine the feasibility of using dental claims data to evaluate dental care. We assign patients to hypothesized stages of care based on receipt of dental procedures and estimate transitions among stages of care with a Markov model. Obtained transition probabilities are validated against those obtained from chart reviews.

4 - Design of Farm to School Programs to Fight Child Obesity: The Case of Mexico

Erika Murguia, TIS Consulting Group, Phoenix, AZ, United States of America, erika.murguia@tisconsulting.org, Rene Villalobos, Gerardo Trevino, Octavio Sanchez

Mexico is considered one of the countries with highest growth in child obesity. To address this problem the Mexican government has undertaken an aggressive program to increase the consumption of fresh fruits and vegetables to substitute food eaten at schools which tend to be high in carbohydrates and fat. We consider the design a logistics network to support direct distribution to schools from the farms while meeting the nutritional requirements mandated by the official guidelines.

■ WC26

26- North 221 A- CC

Managing Health and Risk of Suppliers

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Feryal Erhun, Stanford University, Stanford, CA, United States of America, ferhun@stanford.edu

1 - Supply Allocation to Maintain Supplier Health in Development-Intensive Supply Chains

Mericcan Usta, PhD Candidate, Stanford University, Management Science & Engineering, Stanford, CA, 94305, United States of America, usta@stanford.edu, Feryal Erhun, Warren H. Hausman

We study the impact of the buyer's financial health and R&D generation concerns on his selection of suppliers in a setting where multiple suppliers compete for a divisible supply of fixed value. We analyze the supply allocation as well as supplier finances in equilibrium in single-period and multiple-period settings. Inclusion of financial health concerns reveals dynamics that have been overlooked in the previous literature on supplier selection.

2 - Concealing Information in the Presence of Common Suppliers

Milind Sohoni, Indian School of Business, Gachibowli, Hyderabad, 500032, India, milind_sohoni@isb.edu, Aditya Jain

A privately informed first mover placing order for supply with a common supplier faces the risk of information leakage to competing firms. Thus, first mover firm may wish to actively work with supplier to conceal information. We examine the incentives and strategic effects of such information concealment in a supply chain. We show that in general concealing information help the first mover, but may backfire hand hurt in certain cases.

■ WC27

27- North 221 B- CC

Service Operations: Contracting and Collaboration

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Guillaume Roels, Assistant Professor, University of Southern California, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, guillaume.roels@anderson.ucla.edu

1 - Team Structure in Collaborative Projects

Morvarid Rahmani, PhD Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, morvarid.rahmani.2013@anderson.ucla.edu, Guillaume Roels, Uday Karmarkar

In this paper, we study how teams should be structured in dynamic collaborative projects. Consider, for instance, a team working on developing a new product or service. Should the team organization be flat, letting every member of the team make decisions on the project, or should it be hierarchical, letting a project manager make all decisions on the project?

2 - Guilt by Association: Strategic Failure Prevention and Recovery Capacity Investments

Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu, Brian Tomlin

We examine technological systems consisting of multiple subsystems that are interconnected and may undergo cascading failures upon receiving an external shock. Firms managing these subsystems may invest in two measures to enhance system availability: failure prevention and recovery capacity. Depending on whether only one type of investment is made or both are possible, we find that decentralization may lead to either higher or lower system availability.

3 - Single versus Multisourcing: The Role of Effort Interdependence and Metric-Outcome Misalignment

Sameer Hasija, INSEAD, Fontainbleau, France, sameer.hasija@insead.edu, Shantanu Bhattacharya, Alok Gupta

Many factors influence the costs and benefits of single versus multisourcing. Keeping all other factors equal, in this paper we focus on the role of client-vendor effort interdependence and performance metric-outcome misalignment on informing a firm's sourcing strategy.

4 - Pricing A Service with Observable but Noncontractible Quality for Heterogeneous Customers

Raj Rajagopalan, RSG Media Systems, New York, NY, 10016, United States of America, Srajagop@marshall.usc.edu, Guangwen Kong, Hao Zhang

We consider optimal pricing of a service to two types of consumers with different (private) valuations for service quality. The realized quality is observable but non-contractible and it depends on the service provider's private effort deterministically or stochastically. We consider a variety of pricing schemes and identify scenarios where the service provider may serve only one type of consumer, serve both types with the same quality level, or serve both types with different quality levels.

■ WC28

28- North 221 C- CC

Supply Chain Management and Information

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Hyo duk Shin, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, hyoduk-shin@kellogg.northwestern.edu

1 - Supply Chain Intermediation When Retailers Lead

Elodie Adida, University of California at Riverside, School of Business Administration, Riverside, United States of America, elodieg@ucr.edu, Nitin Bakshi, Victor DeMiguel

We study a three-tier supply chain, where the middle tier consists of intermediaries who compete to mediate between competing retailers and capacity-constrained suppliers. Our model portrays the retailers as Stackelberg leaders. We find that intermediaries should avoid specialty and commodity products, efficiency can be achieved with the right balance of competition at different tiers, and retailers benefit from using intermediaries when it is costly for them to identify or validate suppliers.

2 - Strategic Customers and Commitments in a Decentralized Supply Chain

Ali Parlakturk, Assistant Professor, University of North Carolina-Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, ali_parlakturk@unc.edu, Mustafa Onur Kabul

Consider a decentralized supply chain serving forward-looking consumers in two periods. The supplier and the retailer dynamically set the wholesale and retail price to maximize their own profits. The consumers are strategic in deciding whether and when to buy the product. We show while a centralized system always benefits from making price and quantity commitments, this is not true for a firm in a decentralized supply chain due to how the other firm reacts to such commitments.

3 - Information Sharing in a Supply Chain with Non-Linear Production Costs

Shilu Tong, Australian School of Business, UNSW, School of Information Systems, Sydney, 2052, Australia, sl.tong@unsw.edu.au, Albert Ha, Weixin Shang

We consider a supply chain with two competing manufacturers selling substitutable products through a common retailer. The retailer decides whether to share a private imperfect demand signal with any of the two manufacturers. We consider two cases where the manufacturers face either economies or diseconomies of scale in production. We show how production economies/diseconomies, competition intensity and information contracting influence the firms' equilibrium decisions as well as their profits.

4 - Public Forecast Information Sharing in a Market with Competing Supply Chains

Hyo duk Shin, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, hyoduk-shin@kellogg.northwestern.edu, Noam Shamir

This paper studies the operational motivation of a retailer to publicly announce its forecast information. We show that by making forecast information publicly available to both his upstream manufacturer and competitor, a retailer is able to credibly share his forecast information - an outcome that cannot be achieved by merely exchanging information within the supply chain.

■ WC29

29- North 222 A- CC

Healthcare Operations and Patient Flow Management

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Jonathan Helm, Assistant Professor, Indiana University, Kelley School of Business, ODT, 1309 East Tenth Street, Bloomington, IN, 47405, United States of America, jhelm@umich.edu

1 - Strategic Block Scheduling Optimization in Large Academic Medical Centers

Retsef Levi, Massachusetts Institute of Technology, 100 Main Street, Building E62-562, Cambridge, MA, United States of America, retsef@mit.edu, Timothy Carnes, Bethany Daily, Peter Dunn, Sue Moss, Devon Price, Ana Cecilia Zenteno Langle

Massachusetts General Hospital (MGH) is a large academic hospital that makes use of over fifty operating rooms. Currently the inpatient beds have peak usage in the middle of the week, and are under-utilized on other days. Using an integer programming model to find a feasible adjustment to the surgical block schedule, we are able to find a solution such that the predicted use of inpatient beds is level-loaded, providing an effective increase in capacity.

2 - Stochastic Modeling and Optimization for Clinical Research Integration and Longitudinal Coordination

Jivan Deglise-Hawkinson, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, jivan@umich.edu, Mark Van Oyen, Blake Roessler

The complex resource and time coordination needs of clinical research treatments require forecasting and optimization to extract the highest scientific value about the disease while having a practice performing at the desired service levels for patients and work conditions for nurses. We propose a Capacity Planning Tool and Informatics System that optimizes the proposed clinical research portfolio to perform and the Booking strategy for the chosen portfolio.

3 - Chemotherapy Appointment Scheduling at the BC Cancer Agency

Martin Puterman, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Martin.Puterman@sauder.ubc.ca, Pablo Santibanez, Ruben Aristizabal

This talk reports the results of our three year effort to improve chemotherapy appointment scheduling practices at the BC Cancer Agency. In describes our process review, software development, implementation at the Vancouver Clinic, evaluation, ongoing improvement to address system changes and our experiences implementing the software at a second clinic.

4 - Fast-tracking Priority Customers through Queueing Networks with Application to Destination Hospital

Jonathan Helm, Assistant Professor, Indiana University, Kelley School of Business, ODT, 1309 East Tenth Street, Bloomington, IN, 47405, United States of America, jhelm@umich.edu, Mark Van Oyen, Thomas Rohleder

At a destination hospital, patients travel long distances to receive treatment. For these patients, itinerary completion - defined as the completion of their treatment segment before the weekend – is an important metric. Motivated by itinerary completion, we present a new methodology for modeling and optimizing flows in a network of outpatient clinic visits to minimize flow times of priority patients within a queueing network with hard deadlines for service completion.

■ WC30

30- North 222 B- CC

Advances in Facility Location II

Contributed Session

Chair: Hossein Abdollahnejad, BaroughGraduate Student, Northern Illinois University, 1307, W.Lincoln Highway, DeKalb, IL, 60115, United States of America, habdollahnejadbarough@niu.edu

1 - Robust Optimization for Location Problems

S.M.H. Manzour, University of Oklahoma, Oak 2900, Norman, United States of America, smh.manzour@ou.edu, Theodore Trafalis

Locating plants, distribution centers, warehouses, and other facilities are strategic decisions which can be effected by inherent fluctuation in parameters e.g., customer demands and transportation costs. We apply robust optimization (RO) approach to tackle a family of location problems under demand and transportation cost uncertainty. Three well-known types of uncertainty sets namely box, ellipsoid, and cardinality constraint uncertainty have been investigated to handle input uncertainty.

2 - Dividing a Territory Among Several Facilities

John Carlsson, Assistant Professor, University of Minnesota, 111 Church Street S.E., Minneapolis, MN, 55455, United States of America, jgc@isye.umn.edu

We consider the problem of dividing a geographic region into sub-regions so as to minimize or balance the workloads of a collection of facilities over that region. We show how to construct the optimal boundaries between regions by using a set of dual variables that correspond to "prices" for a facility to serve a demand point. Since the optimal dual variables can be computed efficiently, this allows us to solve the partitioning problem quickly without discretizing the service region.

3 - Locations and Service Start Times of Intermediate Facilities

Ken-ichi Tanaka, Assistant Professor, The University of Electro-Communications, 182-8585 1-5-1, Chofugaoka, Chofu, Tokyo, Japan, ken1tnk@se.uec.ac.jp, Takehiro Furuta

This paper presents a problem of finding intermediate facilities that minimize the sum of arrival times for passenger flows to their destinations. Each flow, which is specified by the departure time of the origin node together with origin-destination nodes, is assumed to visit a facility for predefined hours to consume service after departing the origin node. Optimal service provisions for intermediate facilities are analyzed using railway network data and passenger flow data.

4 - Heuristics for Multiple Server Congested Facility Location Problems with Clearing Functions

Hossein AbdollahnejadBarough, Graduate Student, Northern Illinois University, 1307, W.Lincoln Highway, DeKalb, IL, 60115, United States of America, habdollahnejadbarough@niu.edu, Sukgon Kim

Multiple server clearing functions derived from a GI/G/m queue, are applied to a multiple server location problem to reflect congestion effects on capacity of facilities. A nonlinear mixed-integer programming model is presented. A Column Generation and LR heuristic with a newly developed dynamic programming algorithm are used to solve the problem.

■ WC31

31- North 222 C- CC

Economics of Queues

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Philipp Afeche, Rotman School of Management, University of Toronto, 105 St.George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca

1 - Pricing in Queues without Demand Information

Ramandeep Randhawa, University of Southern California, Los Angeles, CA, United States of America, ramandeep.randhawa@marshall.usc.edu, Moshe Haviv

We consider revenue and social optimization in an M/M/1 queue with price and delay sensitive customers, and study the performance of uninformed pricing that does not require any arrival rate information. For uniformly distributed customer valuations, under a large set of parameters, we find that uninformed prices can capture more than 99% of the optimal revenue and more than 85% of the optimal social welfare.

2 - Revenue Maximization in Queues via Service Differentiation

Costis Maglaras, Columbia University, 3022 Broadway, New York, NY, United States of America, c.maglaras@gsb.columbia.edu, John Yao, Assaf Zeevi

We study a revenue maximization problem for a service system facing a market of heterogeneous, price- and delay-sensitive customers. Using a deterministic relaxation we characterize the optimal (price, delay) menu, and derive a condition in terms of demand elasticities under which service differentiation is optimal. We propose a set of prices, a priority rule, and a strategic delay control policy that is incentive compatible and asymptotically optimal in large systems, and discuss its properties

3 - Signaling via Prices in a Congested Environment

Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu, Senthil Veeraraghavan

High quality of new, innovative products could be signaled to an uninformed consumer segment via high prices. We show that low prices, but, long queues can be more efficient signals of high quality.

4 - Pricing Time-Sensitive Services Based on Realized Performance

Philipp Afeche, Rotman School of Management, University of Toronto, 105 St.George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca, Opher Baron, Yoav Kerner

Services such as Fedex charge an upfront fee but reimburse customers if their orders are delayed. In contrast, most studies of congestion pricing restrict attention to the upfront fee but ignore the possibility of subsequent price adjustments based on realized performance. This paper contributes to filling this gap. It studies for a provider who serves multiple classes of time-sensitive customers the optimal design of more general price contracts that also charge based on actual performance.

■ WC32

32- North 223- CC

Issues in Humanitarian and Sustainable Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Alfonso Pedraza Martinez, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, alpedraz@indiana.edu

1 - Enablers and Barriers for Producer Responsibility in the Photovoltaic Sector

Maria Besiou, Kuehne Logistics University-THE KLU, Brooktorkai 20, Hamburg, 20457, Germany, Maria.Besiou@the-klu.org, Luk Van Wassenhove

This case-based research focuses on how the producer responsibility is implemented in the photovoltaic sector. Transferring the knowledge from the electrical and electronic equipment and the automotive sectors, two sectors with tradition on producer responsibility, factors affecting its implementation in the photovoltaic sector are identified. Then they are categorized into barriers, preventing its implementation, and enablers that will facilitate it.

2 - Supply Chain Structure: Minimizing Costs while Maximizing Disaster Response

Jon Stauffer, Indiana University, 1309 East Tenth Street, Bloomington, IN, 47405, United States of America, stauffer@indiana.edu, Alfonso Pedraza Martinez, Luk Van Wassenhove

We model centralized, decentralized, and hybrid International Humanitarian Organization (IHO) vehicle supply chains and propose the idea of a "temporary network hub" in a major disaster area. This "temporary hub" also helps by decreasing the negative effect of earmarked funding on operational efficiency. We use actual vehicle demand from the International Federation of the Red Cross to feed our models and provide additional insights into IHO supply chains.

3 - Funding Strategies in Humanitarian Operations for Relief and Development

Arian Aflaki, Duke University Graduate School, Durham, NC, United States of America, arian.aflaki@duke.edu, Alfonso Pedraza Martinez

We model funding strategies for relief and development programs in a multi-donor market with donation uncertainty. Donors decide how much to donate to each program; a humanitarian organization decides between 4 different funding strategies: 1) total earmarking; 2) partial earmarking; 3) conditional earmarking; 4) no earmarking. We find that, total earmarking is a dominated strategy, while each of the three other strategies can be a dominant strategy under specific criteria.

4 - Using Real-Time and Crowdsourced Data to Improve Disaster Relief Operations

Luis de la Torre, PhD Candidate, Northwestern University, Technological Institute C236, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, ledelatorre@u.northwestern.edu, Jennifer Chan, Irina Dolinskaya, Karen Smilowitz

Recent efforts such as Crisis Mappers, Ushahidi, and the Humanitarian Open Street Map team have facilitated rapidly disseminated and frequently updated geospatial data, which can be of great benefit to disaster relief and other humanitarian operations. We present an overview of available crowdsourced data and an example of its use. We show how incorporating unstructured real-time data, collected in Haiti in the week following the 2010 earthquake, can improve relief operations in Port-au-Prince.

■ WC33

33- North 224 A- CC

Advertising and Promotion Effectiveness

Contributed Session

Chair: Jun Wu, Savannah State University, 3219 College Street, Savannah, GA, 31410, United States of America, wuj@savannahstate.edu

1 - Verifying the Effectiveness of the E-customer Purchasing Behavior Pattern Model by Cohort Analysis

Fan Wu, The Kyoto College of Graduate Studies for Informatics, 7 MonZen-cho Tanaka Sakyo-ku, Kyoto, 606-8225, Japan, wufanjustdoit@yahoo.cn, Wei Yu, Dong Li, Yun Long Gao, Hong Seung Ko, Jia Lu

Ko.et.al proposed the pattern model for visualizing an e-customer and his or her purchasing behavior in order to retain, and verified the effectiveness of model by correlation analysis and the causality analysis. However, we consider that the cohort analysis is a suitable tool to verify the validity of specific group pattern model than the correlation analysis and the causality analysis. Therefore, we verify the validity of e-customer purchasing behavior pattern model by the cohort analysis.

2 - The Impact of Video on Online Retailer: Analysis of a Natural Experiment

Yinliang(Ricky) Tan, University of Florida, P.O. Box 117169, Gainesville, Fl, 32611-7169, United States of America, tanyinliang@ufl.edu, Anuj Kumar

Product videos are emerging as a prevalent method of advertising in online fashion products retailing. We design and conduct a randomized experiment on the live website of a mid-size fashion retailer in the US to precisely identify the gains in sales due to the introduction of online video description.

3 - Say it Without Saying it: How Consumers Interpret 'Tropes' in Advertising and its Impact on Campaign

Jun Wu, Savannah State University, 3219 College Street, Savannah, GA, 31410, United States of America, wuj@savannahstate.edu, Anshu Arora, Jamin Gordon

The trend in advertising is to have a witty trope or metaphor which appeals to the consumer. Each consumer interprets tropes differently, creating differences in opinions toward the advertised product. The success of an advertising campaign weighs heavily on how consumers will receive a particular message. This research addresses the following questions: 1) how do consumers interpret the figurative language presented? 2)Is the perceived message the same as the intended message of the company?

■ WC34

34- North 224 B- CC

Warehousing and Order-Picking

Contributed Session

Chair: Mohammad A. Quasem, Department of Information & Decision Sciences, Washington, DC, United States of America, mohammadquasem@gmail.com

1 - Order Picking in Mobile-robotic Fulfillment System

Nima Zaerpour, PhD Candidate, RSM Erasmus University, Postbus 1738, Rotterdam, 3000DR, Netherlands, nzaerpour@rsm.nl

We consider a distribution center, which uses mobile-robotic fulfillment system eliminating walking. In such a system, the robots pick up an entire storage pod and bring it to a pick station, from where the products on the pod are distributed over customer bins stored on another pod. We study the retrieval sequencing and location assignment of storage pods leading to minimum robot travel times. We propose a simple efficient heuristic, which can substantially reduce the retrieval time.

2 - Towards a 10,000 Mobile Robot Smart Warehouse

Peter Wurman, CTO, Kiva Systems, 300 Riverpark Dr., North Reading, MA, 01864, United States of America, pwurman@kivasystems.com, Raffaello D'Andrea

Kiva System's mobile fulfillment solution blends techniques from Robotics, Artificial Intelligence, Control Systems, Machine Learning, and Operations Research into the world's largest mobile robotic platform. In operation in over 30 warehouses, Kiva uses hundreds of mobile robots to carry inventory shelves around distribution centers. This talk will describe the application domain and the solution, some of the practical problems that Kiva has solved, and future research challenges.

■ WC35

35- North 225 A- CC

Revenue Management Practices in Media Industry

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Dana Popescu, Assistant Professor of Technology and Operations Management, INSEAD, Fontainbleau, France, dana.popescu@insead.edu

1 - The Value of Bundling in Vertical Markets

Mihai Banciu, Bucknell University, School of Management, 119 Taylor Hall, Lewisburg, PA, 17837, United States of America, mmb018@bucknell.edu, Prakash Mirchandani

We investigate the possible optimal bundling strategies in a market characterized by vertical differentiation and resource scarcity (such as the media market), and compute the value of bundling (VoB) for the buyers, seller(s), and overall. We define the VoB as the net benefit derived by either a buyer or a seller when a bundle is offered, versus when no bundle is available for purchase. We find that the overall bundling benefit is influenced by scarcity and degree of differentiation.

2 - Correcting Audience Externalities in Television Advertising

Kenneth Wilbur, Duke University, 100 Fuqua Drive Box 90120, Durham, NC, 27708, United States of America, kennethcwilbur@gmail.com

We analyze the television network's problem of how to select, order, and price advertisements in order to eliminate audience externalities. We introduce the Audience Value Maximization Algorithm (AVMA), which considers many possible advertisement orderings within a dynamic programming framework with an efficient pricing mechanism. In simulations, AVMA increases audience value 4-14% relative to traditional practices, consistently finds the global optimum and runs quickly enough to implement.

3 - Advertising Revenue Optimization in Live Television Broadcasting

Dana Popescu, Assistant Professor of Technology and Operations Management, INSEAD, Fontainbleau, France, dana.popescu@insead.edu, Ajay Srinivasan, Pascale Crama

In live broadcasting, the break lengths available for commercials may not always be fixed and known ex ante (e.g., strategic and injury time-outs are of variable duration in live sport transmissions). Broadcasters actively manage their revenue by jointly optimizing their sales and scheduling policies. We characterize the optimal dynamic schedule in a setting that incorporates stochastic break durations and ad lengths of 30 and 15 seconds. We also address the portfolio composition problem.

4 - Scheduling TV Advertisements with Uncertain Ratings

Sriram Subramanian, RSG Media Systems, New York, NY, 10016, United States of AmericaSriramSu@rsgsystems.com, Sebastian Souyris, Sridhar Seshari

Television ratings have significant volatility in audience composition that affect effective scheduling of advertisements. We propose a robust optimization approach to address the rating uncertainty in order to maximize the yield under the realization of adverse scenarios that can happen with no negligible probability. In this talk we will discuss the robust problem formulation and the degree of conservatism represented by the trade off between robust solutions and nominal problem solutions.

■ WC37

37- North 226 A- CC

Dynamic Pricing and Applications

Contributed Session

Chair: Daniel Covarrubias, Scientist, PROS Pricing, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dcovarrubias@prospricing.com

1 - Using Outlier Detection in Wholesale Petroleum Pricing

Daniel Covarrubias, Scientist, PROS Pricing, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dcovarrubias@prospricing.com, Neil Biehn, Evan Brott

Pricing in the wholesale petroleum market is a very difficult task. Pricers must predict what competitors will do in order to place themselves at the desired competitive position. With today's volitile energy industry, pricing accuracy quickly degrades. We propose an outlier detection methodology that reduces the impact of highly volitile days to future predictions. Examples will be provided showing significantly improved accuracy measurements compared to previous approaches.

2 - Step-price Heuristic: Frugal Information use in the used Car Market

Florian Artinger, Dr., Max Planck Institute for Human Development, Lentzeallee 94, Berlin, 14195, Germany, artinger@mpib-berlin.mpg.de, Gerd Gigerenzer

Which pricing strategies do firms employ in a dynamic pricing context where there is substantial uncertainty about the best price? We use pricing data of 748 dealers from an online used car market and interviews with 55 dealers. More than half of all dealers use the 'step-price' heuristic: starting out with a high price, they lower it in fixed time intervals until the car sells. Price changes at fixed time intervals and frugal information use lead to systematic price rigidity and dispersion.

3 - Dynamic Pricing with Reference Price Updating Strategies and Customers' Memory Window Effects

Dash Wu, Associate Professor, Reykjavik University and Affiliate Professor, RiskLab, University of Toronto, Toronto, ON, Canada, DWu@Rotman.Utoronto.CA

We consider a dynamic pricing model where consumers' purchase decisions are affected by updated reference prices. We propose an innovative behaviorally motivated reference price updating mechanism based on moving memory windows. We compare the proposed "first-end" anchoring with existing work of exponential smoothing and "peak-end" anchoring explicitly and show that memory window is important in forming reference prices.

■ WC38

38- North 226 B- CC

Big Data: Analytics and Applications

Sponsor: Service Science

Sponsored Session

Chair: Yingdong Lu, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, yingdong@us.ibm.com

1 - MapReduce Schedulers: Performance Analysis and Design

Li Zhang, IBM T. J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, United States of America, zhangli@us.ibm.com, Jian Tan, Xiaoqiao Meng

MapReduce is a popular programming framework for the parallel processing of large data on a cluster. MapReduce jobs are composed of map and reduce tasks with tight dependence between them. Due to the large number of jobs sharing limited resources, an efficient job scheduler is critical for improving system performance and resource utilization. We present analytical and experimental studies of existing job schedulers. We also introduce our own job scheduler with superior performance.

2 - Scalable Data Analytics with Uncertainty

Yingdong Lu, IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, yingdong@us.ibm.com, Mark Squillante

We provide an overview of some IBM research efforts on Scalable Data Analytics. In particular, we discuss current research problems in the space of data analytics applications and workloads together with the solution methodologies being developed to address these problems

■ WC39

39- North 226 C- CC

Topics in OM-Marketing Interface

Contributed Session

Chair: Kunpeng Li, Sam Houston State University, College of Business Administration, Huntsville, TX, United States of America, kli@shsu.edu

1 - Marketing Resource Allocation for a New Product Introduction

Vahideh Sadat Abedi, PHD Candidate, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, VahidehSadat.Abedi07@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

The profitability of a new product or service introduction, especially over its short life cycle, depends on firm's ability to efficiently market the product. However, heterogeneous preferences and knowledge of customers make proper targeting of marketing activities critical in order to properly spread the reputation and motivate the right customers with the right messages through the right channel. We derive some structural properties of the problem and present allocation solution method.

2 - Managing Service Quality over Time under the Influence of Social Interaction

Xuchuan Yuan, PhD & Research, NUS Business School, 1 Business Link, Biz 2 Building ,B2-03, Singapore, 117592, Singapore, g0800755@nus.edu.sg, Brian Hwarng

This paper investigates the optimal service quality strategy under the influences of social interactions. Heterogeneous customers' expectations are randomly distributed and shaped by experiences which are adaptively formed. Expectations and experiences determine customers' satisfactions which influence potential customers' purchase decisions through social interactions. The optimal quality strategies under various situations and sensitivity analysis on social interaction strength are derived.

3 - System Components Bundling

Kunpeng Li, Sam Houston State University, College of Business Administration, Huntsville, TX, United States of America, kli@shsu.edu, Dilip Chhajed, Suman Mallik

We develop a game-theoretic method to study optimal business-model strategies in the computer-based industries. We investigate both monopoly and duopoly cases.

4 - Disproportionate Positivity and Negativity Biases of Brand Extension Information

Joseph Chang, University Professor of Marketing, Vancouver Island University, 900 Fifth Street, Nanaimo, BC, V9R 5S5, Canada

Under high-accessibility scenarios, negativity extension biases on high-entitative family brands were more salient. The disproportionate biases turn to be more sophisticated under low-accessibility situations. The negativity (vs. positivity) biases of similar extension information on both high- and low-entitative family brands were more salient, whereas the negativity (vs. positivity) biases of dissimilar extension information on high-entitative family brands were more salient.

■ WC40

40- North 227 A- CC

Grids

Contributed Session

Chair: Cong Liu, Computational Engineer-Energy Systems, Argonne National Laboratory, 9700 South Cass Ave., Building 221, Argonne, IL, 60439, United States of America, liuc@anl.gov

1 - Structural Properties of Power Grid Design

Stephan Lemkens, RWTH Aachen University, Lehrstuhl II für Mathematik, RWTH Aachen, Aachen, 52056, Germany, lemkens@math2.rwth-aachen.de, Arie M.C.A. Koster

The problem of designing a minimal power grid is often stated as a mixed integer linear program using the DC power flow linearization. We consider its projection on the integral space, as every feasible integral point can be considered as a possible grid design. We define the DC power grid design polytope as the convex hull of these points. We discuss structural properties of this polytope for bounded and unbounded power flows and give an insight into its computational complexity.

2 - Towards Optimal Behavior of Micro-grids in Electricity Market

Niloufar Sadat Mirhosseini, PhD. Candidate, Rutgers University, 23591 B.P.O. Way, Piscataway, NJ, 08854, United States of America, niloofar@eden.rutgers.edu, Mohsen Jafari

The progressive integration of micro-grids into the power grid makes it necessary for micro-grid owners to use new business models. We propose necessary tools to optimally strategize micro-grids interactions with the power grid assuming different risk attributes for the micro-grid owner. We also consider renewable and conventional storage options and propose techniques for storage valuation in terms of both value generation and risk reduction for the micro-grid.

3 - Coupled Weather and Optimization Model for the Power Grid

Thomas Edmunds, Chief Engineer, Energy Systems Analytics, Lawrence Livermore National Laboratory, 3252 Arbor Dr, Pleasanton, CA, 94566, United States of America, edmunds2@llnl.gov

Coordinating the intermittent generation from wind and solar resources with controlled generation from thermal units presents a challenge to grid operators. The increasing penetration of demand response and storage assets provides an opportunity to manage the variability of renewables. We present a weather model of the western U.S. used to estimate renewable production that drives a stochasitic production optimzation model. The coupled model can be used for planning and operating the grid.

4 - Tractable Multi-area Optimal Power Flow in Switchable Transmission Network

Cong Liu, Computational Engineer-Energy Systems, Argonne National Laboratory, 9700 South Cass Ave., Building 221, Argonne, IL, 60439, United States of America, liuc@anl.gov

The optimal transmission switching problem can be modeled as MIP or disjunctive programming formulation. The purpose of this work is to use graph participation to separate the whole power network into several sub-networks. Lagrangian multipliers and penalty terms will be used to relax the boundary power flow variables of tie-lines between two adjacent areas. The upper bound and lower bound can be updated iteratively. The program will stop once the gap satisfies a predefined value.

■ WC41

41- North 227 B- CC

Supply Chain in Petroleum / Petrochemical Companies

Sponsor: Energy, Natural Res & the Environment/Mining

Sponsored Session

Chair: Margery Connor, Senior Technology Strategist, Chevron, 6001 Bollinger Canyon Road, San Ramon, CA, 94588, United States of America, MHCO@chevron.com

1 - Stochastic Simulation for Sasol Solvents Global Tank Planning

Ester Vermaak, Senior Operations Researcher Gr 1, Sasol Technology, 1 Klasie Havenga Street, Sasolburg, 1947, South Africa, ester.vermaak@sasol.com, Leilani Meijer, Louis Snyders

The stochastic Sasol Solvents Global Tank Planning model was developed to provide a dynamic view of the global storage network for the Solvents business unit. This model provides the capabilities to simulate and evaluate current and future storage capacities and inventory development for multiple products when considering volume allocations and sales patterns in different regions. The model has been used in the business case for a re-configuration of current storage capacities.

2 - Practical Application of Stochastic Simulation within the Supply Chain Environment

Jaco Joubert, Principal Operations Researcher, Sasol Technology, 33 Baker Street, Baker Square, Rosebank, 2196, South Africa, jaco.joubert2@sasol.com, Gerhard Carstens

The Sasol Nitro explosives business unit identified finished goods storage capacity as a constraint. It is complicated to expand storage capacity due to safety / EIA regulations and therefore imperative that available capacity be used optimally. Stochastic simulation was used to demonstrate the benefits of maximising product flow across the supply chain. An alternative inventory management system resulted in an increase in supply chain throughput capacity without additional storage capacity.

3 - Evaluating Supply Chain Decisions in the Additives Business

Peter Schipperijn, Optimization Engineer, Chevron, 1400 Smith, Room 17137, Houston, TX, 77002, United States of America, APSC@chevron.com

Chevron Oronite has developed a business economics model to help guide strategic and tactical decision making in the supply chain. Examples of such decisions are exploring the value of manufacturing process expansion, understanding the tradeoffs of site rationalization, new sales evaluation, and product source optimization. With after-tax profit maximization as its objective, the underlying LP technology allows potential changes in the supply chain to be evaluated holistically.

■ WC42

42- North 227 C- CC

Network Design in Transportation

Contributed Session

Chair: Mostafa Mollanejad, University of Maryland, 3424 Tulane Drive, Hyattsville, MD, United States of America, mostafa@umd.edu

1 - The Optimal Allocation of Charging Infrastructures for the Wireless Charging Electric Vehicle
Young Jang, Assistant Professor, KAIST, 291 Daehak-ro, Daejeon, Korea, Republic of, yjang@kaist.ac.kr

The On-Line Electric Vehicle (OLEV) is the transportation system utilizing the wireless charging technology. The battery in the OLEV system is charged remotely from the power transmitters buried under the road. Also the charge can be done automatically while the vehicle is in motion. We present a mathematical model to optimize the key parameters of the automated charging solution in the OLEV.

2 - Robust Hub-and-Spoke System Design with Congestion
Yu An, University of South Florida, 3602 Jefferson Commons Drive, Apt. 302, Tampa FL 33613, Tampa, FL, 33613, United States of America, yan2@mail.usf.edu, Bo Zeng, Yu Zhang

We consider a robust hub-and-spoke design problem with congestion where disruptions at hubs can be mitigated by alternative routes. It builds a nonlinear mixed integer programming model and we use Benders Decomposition and approximation methods to solve it. Numerical study is reported along with some management insights.

3 - Simulation and Optimization of Charging Infrastructure for Electric-drive Vehicle Fleets
Kostja Siefen, University of Paderborn, Warburger Str. 100, Paderborn, 33098, Germany, siefen@dsor.de

Electric-Drive Vehicle Fleets need proper charging infrastructure available in the area of operation. The number of potential locations can be quite large with differing costs for preparation, installations, operation and maintenance. We present a planning approach based on vehicle movement scenarios. We use simulation to evaluate the impact of different infrastructure and present an optimization model for a cost-minimal selection of locations and capacities.

4 - Two-Stage Optimal Capacity Design and Expansion in Survivable Transportation Networks
Shahrzad Azizzadeh, PhD Candidate, NCSU, R5421, 500 SAS Campus Drive, Cary, NC, 27513, United States of America, sazizza@ncsu.edu, Ranji Ranjithan, Yahya Fathi

Transportation networks components are usually vulnerable to large scale urban disasters. We study the problem of optimal capacity design and expansion in survivable transportation networks facing many probabilistic non-simultaneous failure scenarios. We present an integer programming formulation of the problem, investigate the structural properties of the model and present a decomposition solution approach.

5 - Incorporating Equity into Road Network Design
Mostafa Mollanejad, University of Maryland, 3424 Tulane Drive, Hyattsville, MD, United States of America, mostafa@umd.edu, Lei Zhang

Traditional models for road network design optimize network efficiency measures like total travel time. In this way, most of improvements are made next to larger cities, which is not consistent with sustainable development objectives. In this paper, travel time to the neighboring opportunities is utilized to propose a new definition for accessibility which captures the reality more effectively. With the help of this definition, equity is incorporated into road network design problem implicitly.

■ WC43

43- North 228 A- CC

Strategic Issues in Rail Transportation

Contributed Session

Chair: Guvenc Sahin, Assistant Professor, Sabanci University, Sabanci University FENS, Orhanli, Tuzla, Istanbul, 34956, Turkey, guvencs@sabanciuniv.edu

1 - Pigovian Taxes on Railway Infrastructure Usage
Arnt-Gunnar Lium, Research Scientist, SINTEF Technology and Society, S.P. Andersensvei 5, Trondheim, NO-7465, Norway, arnt-gunnar.lium@sintef.no, Adrian Tobias Werner, Thor Björkvoll

There is a strong variation in the demand for access to European railroad infrastructure at different times of day. We look into how positive and negative Pigovian taxes can be used to smoothen demand for access to railroad infrastructure in order to improve the overall utilization.

2 - Rail Car Fleet Design: Optimization of Structure and Size
Steffen Klosterhalfen, Operations Research Specialist, BASF SE, GVM/S-B009, Ludwigshafen, 67056, Germany, steffen.klosterhalfen@basf.com, Josef Kallrath

We study the problem of how to design the rail car fleet of a chemical company in terms of structure and size. First, we develop an MILP model that minimizes the total rail car cost under given availability constraints on the different rail cars types. Second, safety stocks are approximated based on the rail car type-request assignment found by the MILP solution.

3 - Tactical and Strategic Crew Planning Problems in Railways
Guvenc Sahin, Assistant Professor, Sabanci University, Sabanci University FENS, Orhanli, Tuzla, Istanbul, 34956, Turkey, guvencs@sabanciuniv.edu, Ali Cetin Suyabatmaz, Fardin Dashty Saridarq, Mustafa Sahin

We consider the tactical level crew planning problem in railways that determines the minimum sufficient crew resources level for one crew region at a time and strategic level counterpart of the problem that simultaneously consider multiple regions. We provide a set covering type formulation and a network flow formulation for the tactical level problem; the network flow formulation is superior even with complicating hard constraints. Therefore, we extend it to model the strategic level problem.

■ WC44

44- North 228 B- CC

Supply Chain: Risk Management in Procurement

Contributed Session

Chair: Hugo DeCampos, Doctoral Candidate, Michigan State University, 4461 Alderwood Drive, Okemos, MI, 48864, United States of America, decampos@msu.edu

1 - Supply Chain Competition with Financial Derivatives
Eissa Nematollahi, Post-Doctoral Fellow, University of Calgary, 2500 University Dr NW, Calgary, T2N 1N4, Canada, enematol@ucalgary.ca, Yuriy Zinchenko, William Rosehart, Janne Kettunen

Market prices often fluctuate by large amounts over a short time period. This price volatility directly affects producers, wholesalers, retailers, and consumers. We develop an equilibrium model of a supply chain with multiple producers and wholesalers who trade financial derivatives to hedge against risks caused by wholesale price volatility. Moreover, we establish optimal bounds on the equilibrium price of each derivative, when no distributional assumption is made on the wholesale price.

2 - Role of Uncertainty of Demand and Product Yield in Remanufacturing
Samar Mukhopadhyay, Professor, SKK University GSB, 53 Myungryun dong Jongno gu, Seoul, Korea, Republic of, samar@skku.edu, Huafan Ma

An OEM (original equipment manufacturer) processes both used and new parts for production of new products. The yield of the used parts procured for remanufacturing is random. The OEM makes procurement and production decisions and the single retailer makes ordering decisions. The two parties use either a push or a pull contract and the manufacturing lead times can be short and long. We develop a model to obtain their optimal policies for different scenarios depending on the contract type.

3 - Risk-averse Procurement Decision under Spot Price and Production Uncertainty
Lei Shu, Xi'an Jiaotong University, Xianning West Road No. 28, Xi'an, China, shulei@stu.xjtu.edu.cn, Feng Wu

In this paper, we address the issue of a pull production system where long-term contract and spot market are available for inputs. The spot price and production rate are random. A manufacturer needs to make procurement decision in the face of these uncertainties. A bilevel programming model is presented to determine the optimal procurement time and volume. Sensitivity analyses on various problem parameters have been conducted through numerical analyses using genetic algorithm.

4 - How Much Supplier Squeezing is too Much?
David Wuttke, Institute for Supply Chain Management-Procurement and Logistics (ISCM)/ EBS Business School, Konrad-Adenauer-Ring 15, Wiesbaden, 65187, Germany, david.wuttke@ebs.edu, Constantin Blome, Philippe Chevalier

Powerful buyers face a fundamental trade-off when negotiating with their suppliers: While using too little power leads to lost savings, using too much power weakens suppliers and ultimately the supply chain, leading to long-term costs for the buyer. In our model we seek to identify the optimal degree of power use. Departing from a collective action framework, the model considers consequences of competing buyers' squeezing behavior as well as factors such as risk aversion and myopia.

5 - An Outcome-driven Strategic Purchasing Portfolio Theory
Hugo DeCampos, Doctoral Candidate, Michigan State University, 4461 Alderwood Drive, Okemos, MI, 48864, United States of America, decampos@msu.edu, Steven Melnyk

As supply chain organizations are called upon to deliver a diversity of outcomes such as cost, security, sustainability, innovation, agility and resilience, a more mature sourcing strategy is needed to assure that appropriate capabilities exist within a firm's supply base. This research proposes an approach based on financial investment portfolio theory where a diversity of assets (suppliers) is maintained in deliberate proportions according to the risk and outcome profiles desired.

■ WC45

45- North 229 A- CC

Joint Session MIF/HAS: Healthcare Informatics and Optimization

Sponsor: Minority Issues & Health Applications Society

Sponsored Session

Chair: Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, KGCOE-1593, Rochester, NY, 14623, United States of America, rpmeie@rit.edu

1 - Understanding Secure Messaging Patterns between Patients and Care Teams
Mustafa Ozkaynak, Postdoctoral Fellow, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA, United States of America, mozkaynak@wpi.edu, Bengisu Tulu, Stephanie L. Shimada, Susan S. Woods, Sharon Johnson

Secure messaging (SM), electronic and asynchronous communication between patients and healthcare teams, is a core function of personal health records systems. We examine SM patterns in two medical centers. Understanding these patterns allows obstacles and facilitators of SM use to be identified, and provides opportunities for improving care delivery at the operations and policy level.

2 - A Clinical Decision Tool for Predicting Patient Care Characteristics
Eva Lee, Professor and Director, Industrial and Systems Engineering Georgia Institute of Technology, Georgia Institute of Technology, Atlanta, GA, United States of America, eva.lee@gatech.edu, Fan Yuan

This work is joint with Grady Memorial Hospital and the Children's Healthcare of Atlanta. We focus on on identifying reasons behind the recurrence of patient admissions, and designing classification models to predict potential readmissions.Large scale data analysis and results will be presented. This is critical given the Affordable Care Act is beginning to implement readmission penalties. The algorithmic approach could detect readmission triggers without human monitoring.

3 - Optimizing Contact Tracing for a Pertussis Outbreak in a Local Health Department
Emine Yaylali, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, eyaylal@ncsu.edu, Julie S. Ivy, Reha Uzsoy

We developed a discrete-event simulation model of a local health department and its response to a pertussis outbreak. Contact tracing, a key mitigation method for pertussis, is modeled using the NC DHHS case data. The impact of the time to initiate response and the resource availability of the health department on outbreak management policies are explored and optimal response policies are developed.

4 - Modeling Papient Migration Behavior for Congestive Heart Failure Readmissions
Sezgin Ayabakan, PhD Student, University of Texas at Dallas, 800 W. Campbell Road, Richardson, TX, 75080, United States of America, ayabakan@utdallas.edu, Indranil Bardhan, Zhiqiang Zheng

The literature does not consider the migration of patients across hospitals, which leads to an underestimation of readmission rates. We model the readmission of CHF patients by accounting for patient migration across hospitals in North Texas. We develop a Hidden Markov model to predict readmission rates associated with CHF patients.

5 - An Integrated Operating Room Scheduling System
Shailendra Jain, Distinguished Technologist & Project Manager, Hewlett-Packard Laboratories, 1501 Page Mill Road, Bldg 1U, MS 1132, Palo Alto, CA, 94304, United States of America, Shailendra.Jain@hp.com, Haiyan Wang, Sharad Singhal, Cipriano Santos, Jaap Suermondt, Dr. Karl Sylvester, Enis Kayis, Meghna Patel, Dr. RJ Ramamurthi

The operating room is a critical resource in the hospital, and OR scheduling is a challenging and critical problem. We report on a joint project with Lucile Packard Children's Hospital to develop an OR planning and scheduling system, which is based on optimization and simulation models.

■ WC46

46- North 229 B- CC

Corporate Considerations in Sustainabiity

Contributed Session

Chair: Wenbo Shi, Iowa State University, 3004 Black Engineering, Ames, IA, United States of America, wenboshi@iastate.edu

1 - The Value of Corporate Social Responsibility
Wei Chen, PhD Candidate, University of Pittsburgh, 241 Mervis Hall, Roberto Clemente Drive, Pittsburgh, PA, 15260, United States of America, wchen@katz.pitt.edu, Jennifer Shang

Corporate Social Responsibility(CSR) has received increasing attention. However the value of CSR hasn't been explicitly explored. We propose a framework to integrate CSR into corporate's revenue management. Our model reflects the value of CSR in both the growth in revenue and reputation. Therefore, engaging appropriate level of CSR activities benefits firms bottom line.

2 - Decommissioning of Renewable Power Plants
Wenbo Shi, Iowa State University, 3004 Black Engineering, Ames, IA, United States of America, wenboshi@iastate.edu, K. Jo Min

With the recent installations of renewable power plants on a massive scale, there have been increasing concerns regarding the decommissioning of such plants. In this paper, we first formulate a closed loop supply chain model consisting of a hauler and a landfill operator. From this model, we will investigate the relationships among reuse, landfill, and abandonment under the current environment. Various managerial insights and economic implications will be discussed.

■ WC48

48- North 231 A- CC

Facility Logistics VI

Sponsor: Transportation Science & Logistics/ Facility Logistics

Sponsored Session

Chair: Dima Nazzal, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, dnazzal@mail.ucf.edu

1 - Energy Station Location Problem in a Transportation Network with Autonomous Users
Yingyan Lou, Assistant Professor, The University of Alabama, 260 H.M. Comer, Tuscaloosa, AL, 35487, United States of America, ylou@eng.ua.edu, Burcu Keskin, Mohammad Miralinaghi

This study addresses the energy station location problem (SLP) in a transportation network. We first develop a capacitated SLP with constant travel time and stepwise delay function at each station. We also extend this model to consider varying travel time and continuous delay function with autonomous users following the user equilibrium conditions to better capture travelers' behaviors in the network. These models are solved by specialized branch-and-bound and Lagrangian relaxation algorithms.

2 - A Closed Queueing Network Approach to Analyzing Multi-vehicle Material Handling Systems
Dima Nazzal, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, dnazzal@mail.ucf.edu

A multi-vehicle material handling system is modeled as a closed loop queueing network with finite buffers and general service times, where the vehicles represent the jobs in the network. This type of network differs from other queueing systems, because vehicles' residence times on track segments (servers) depend on the number of jobs (vehicles) in circulation. A new iterative approximation algorithm is developed to estimate throughput capacity of the MHS.

3 - A Location-inventory Model for Determining Station Locations and Fleet Size for Shared-Use Vehicles

Burak Boyaci, Research Assistant, Ecole Polytechnique Federal de Lausanne, EPFL ENAC INTER LUTS, GC C2 406 (Bâtiment GC) Station 18, Lausanne, 1015, Switzerland, burak.boyaci@epfl.ch, Nikolas Geroliminis, Konstantinos Zografos

The problem of determining the fleet size and location of shared-use electric vehicle stations is modeled as a combined maximal covering inventory model. An efficient algorithm is used for solving the proposed model. We report results from the application of the model and algorithm to a real world problem with electric vehicles in the city of Nice.

4 - Determining Locations for Variable Message Signs in Urban Networks

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, Rouyu Liu

Variable message signs should be located to improve system-wide traffic conditions, yet their impact cannot be easily predicted due to drivers reacting in a user-optimal, rather than system-optimal, manner. This research uses a genetic algorithm to find effective solutions, using the cell transmission model to propagate traffic flow and a dynamic, bounded-rational equilibrium concept.

5 - Reliable Infrastructure Location Design under Interdependent Disruptions Caused by Supporting System Failures

Xiaopeng Li, Mississippi State University, P.O. Box 9546, 235L Walker Hall, 501 Hardy Road, Mississippi State, MS, 39762, United States of America, xli@cee.msstate.edu, Yanfeng Ouyang, Fan Peng

This paper addresses facility location design under interdependent facility disruption risks due to shared usage of supporting stations that themselves are fallible. We consolidate the problem of minimizing the total expected system cost with regard to location selections under an exponential number of disruption scenarios into a compact polynomial-size integer programming model. This model can be efficiently solved by proposed customized algorithms.

■ WC49

49- North 231 B- CC

School Bus Modeling

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: William Ellegood, University of Missouri-St. Louis, College of Business Administration, St. Louis, MO, 63121, United States of America, wevf6@mail.umsl.edu

1 - Continuous Approximation Modeling for Mixed Load School Bus Routing

William Ellegood, University of Missouri-St. Louis, College of Business Administration, St. Louis, MO, 63121, United States of America, wevf6@mail.umsl.edu, James Campbell, Jeremy North

School bus transportation is an expensive and challenging mandated service in rural and semi-rural public school districts. We develop continuous approximation models of bus routes to analyze the potential for reducing travel distance with mixed loads of students (i.e. students for different schools are carried on the same bus) and consolidation of bus stops. Results document the savings as a function of the district shape, the distribution of students and bus stops, and the routing policy.

2 - Optimizing Mixed Load School Bus Routing

Jeremy North, University of Missouri-St. Louis, College of Business Administration, St. Louis, MO, 63121, United States of America, Jeremy.w.north@mail.umsl.edu, James Campbell, William Ellegood

School bus routing with mixed loads of students (i.e. students for different schools are carried on the same bus) is a challenging variant of the VRP. We present a two-phase algorithm for mixed load school bus routing, where the first phase is a savings-based heuristic to form mixed load trips visiting multiple schools, and the second phase is an MIP to link trips into bus routes. Results with benchmark data sets and a rural district show improvements in the number of buses and travel distance.

3 - On (Re)designing Routes for Bus Rapid Transit (BRT) Systems

Andrès L. Medaglia, Associate Professor, Universidad de los Andes, Departamento de Ingenieria Industrial, Carrera 1 Este # 19 A-40, Bogotá, Colombia, amedagli@uniandes.edu.co, Jose F. Bravo, Jaime E. González

Once a BRT system is in operation, it is often necessary to adjust the routes to improve the system's performance. Congestion is perhaps the single most important decision criterion to (re)design the BRT routes. Thus, we present a network-oriented formulation and a heuristic approach based on congestion estimates useful to (re)design the BRT routes.

■ WC51

51- North 232 A- CC

RAND Corporation Military Applications Research

Sponsor: Military Applications

Sponsored Session

Chair: Adam Resnick, RAND Corporation, 1776 Main St, Santa Monica, CA, United States of America, adam_resnick@rand.org

1 - The Electronic Decision Enhancement Leverager Plus Integrator (E-DEL+I™) Analytic Process

Carolyn Wong, RAND Corporation, 1776 Main Street, Santa Monica, CA, United States of America, wong@rand.org

The Electronic Decision Enhancement Leverager plus Integrator (E-DEL+I™), provisional patents, RAND) is a capability for integrating diverse views on complex issues involving many stakeholders and multiple critical dimensions. Often technical knowledge must be blended with understandings of operations and policy to arrive at solutions acceptable to all stakeholders. E-DEL+I has been used in consensus building for solution generation, conflict resolution, and strategic definition of next steps.

2 - Long Term Planning for USAF Weapon Systems, Under Deep Uncertainty

Jonathan Klenk, Pardee RAND Graduate School, 1776 Main Street, Santa Monica, CA, 90401, United States of America, jklenk@rand.org

As the acquisition of aircraft for the US Combat Air Forces involves long planning horizons, the eventual demand for such aircraft is difficult to estimate given its dependency on uncertain futures. To better inform the choice of strategies to acquire new CAF aircraft and retire old ones, we formulate a problem to minimize the risk of not meeting national security demands given the random occurrence of threat scenarios over thirty years, constrained by the budget and other force parameters.

3 - A Queuing Network to Improve the U.S. Military Service Member Disability Rating Process

James Broyles, RAND Corporation, 1776 Main Street, Santa Monica, CA, United States of America, jbroyles@rand.org, Heather Krull, Matthew Haugseth

Wounded U.S. veterans can obtain a disability rating that determines their fitness to serve and their compensation. By integrating processes, average rating time has decreased from 540 to less than 305 days. However, management is unsure where to make process improvements for the largest time benefit. This research presents a queuing network with queuing-based statistical approaches to estimate unobserved parameters using Army data. The results include recommended areas for improvement.

4 - Improving the Effectiveness and Lowering the Cost of the US Military Medical Distribution System

Adam Resnick, RAND Corporation, 1776 Main St., Santa Monica, CA, United States of America, adam_resnick@rand.org

The US Military delivers medical supplies from suppliers in the United States to its overseas operating locations, including treatment facilities, distribution centers, and operational units. We identify opportunities to gain efficiency in: contracting, vendor delivery, intermediate warehousing, and final distribution. We discuss policies the military should consider to improve its global medical supply operations.

■ WC52

52- North 232 B- CC

Joint Session ENRE/OPTIM: Stochastic Programming Applications in the Energy Industry

Sponsor: Energy, Natural Res & the Environment/Energy & Optimization/Stochastic Programming

Sponsored Session

Chair: Pavan Murali, Research Scientist, IBM Research, 19 Skyline Dr, 4S-G54, Hawthorne, NY, 10532, United States of America, pmurali@usc.edu

Co-Chair: Pavithra HarshaResearch Staff Member, IBM Research, 1101 Kitchawan Rd, 34-225, Yorktown Heights, NY, 10598, United States of America, pharsha@us.ibm.com

1 - Dynamic Demand Management via Smart Grids

Pavithra Harsha, Research Staff Member, IBM Research, 1101 Kitchawan Rd, 34-225, Yorktown Heights, NY, 10598, United States of America, pharsha@us.ibm.com, Mayank Sharma, Soumyadip Ghosh, Ramesh Natarajan

Demand management as a way to modulate the aggregate load using 'price incentive signals' to find the lowest cost supply-demand match is of considerable interest in the emerging smart grids. We formulate the demand management problem as a price-sensitive newsvendor and present results for various types of demand response schemes that differ with the type and form of the signals, providing insights into the practical design of such schemes.

2 - Centralized Topology Control and Enhanced Distribution Network LMPs for T&D Resilience

Michael Caramanis, Professor, Boston University, Division of Systems Engineering, 15 Saint Mary's Street, Brookline, MA, 02446, United States of America, Mcaraman@bu.edu, Pablo Ruiz, Justin Foster

T&D infrastructure resilience is a key objective of efforts for the triple sustainability — environmental, economic and energy security – of massive clean energy generation integration. We will outline new directions towards this end encompassing (i) practical Dynamic Transmission Network Reconfiguration and (ii) expanded Distribution Network Locational Marginal Cost-based Pricing.

3 - Charging Electric Vehicles under Capacity and Pricing Constraints

Pavan Murali, Research Scientist, IBM Research, 19 Skyline Dr, 4S-G54, Hawthorne, NY, 10532, United States of America, pmurali@usc.edu, Ajay Deshpande, Bruno Flach

We present a 2-stage stochastic program to address the problem of scheduling EV charging in commercial locations (malls, offices etc) when the price of charging, p, ($/kWh) depends on dwelling duration. We present methods to determine p and schedules (recourse action) when price of electricity is either fixed or is sensitive to the time-of-day, while maximizing demand met.

■ WC53

53- North 232 C- CC

Intelligent Algorithms on Smart Grids

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Daniel Bienstock, Columbia University, Department of IEOR, New York, NY, United States of America, dano@columbia.edu

1 - Robust DC-OPF

Daniel Bienstock, Columbia University, Department of IEOR, New York, NY, United States of America, dano@columbia.edu

We present a chance-constrained optimization model for incorporating uncertain generation resources into an existing grid. The model incorporates both the uncertainty in the resources together with an optimal control scheme; this gives rise to a sparse, second-order optimization model. We describe computational experience with several data sets and provide qualitative observations on the results. Joint work with M. Chertkov (Los Alamos) and S. Harnett (Columbia Applied Math).

2 - Demand Response on a Smart Grid

Garud Iyengar, Professor, Columbia University, New York, NY, United States of America, garud@ieor.columbia.edu, Carlos Abad

In this talk we will describe an effective algorithm for demand response that reduces the power requirements for the network as a whole while ensuring that the network always remains stable.

3 - Grid Expansion Planning with Operations Modeling

Russell Bent, Los Alamos National Laboratory, Mail Stop C933, P.O. Box 1663, Los Alamos, NM, United States of America, rbent@lanl.gov

Grid expansion planning has become increasingly complex and challenging due to the integration of renewable generation, smart grid devices, and novel markets. These integrations make it important to include details of grid operations when planning (AC power flows, market models, controls, etc.) to avoid loop flows, negative prices, and other undesirable operations. We present a flexible algorithm for solving grid expansion planning problems that can accommodate more detailed operations models.

4 - Controlling Energy Consumption in Data Center Servers: An MDP-based Approach

Arupa Mohapatra, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, arupa@tamu.edu, Cesar Mateus, Natarajan Gautam

Server energy consumption in data centers has skyrocketed recently. In this research we propose to develop control policies to power servers on and off, as well as determine their operating speeds to improve energy-efficiency. We develop a Markov decision process model to characterize the optimal policy, develop insights on its structure, and describe methods to expeditiously obtain them for large problem instances.

■ WC55

55- Regency Ballroom B - Hyatt

Decisions in Product Development II

Contributed Session

Chair: Bimal Nepal, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, United States of America, nepal@tamu.edu

1 - New Product Introduction, Modularity, and Sustainability

John Khawam, Assistant Professor, Naval Postgraduate School, 555 Dyer Rd., Monterey, CA, 93943, United States of America, jhkhawam@nps.edu, Stefan Spinler

A manufacturer has the ability to introduce new products with modularity. Modularity affects the profit and sustainability of the product. A modular product contains modules that can be removed and replaced. The manufacturer can develop new modules rather than entirely new products. Customers buying upgraded modules only dispose of a portion of the product–reducing the total amount of waste. We study the tradeoff between the profits and the sustainability of modular and non-modular products.

2 - Application of Integrated Product and Process Development (Value Stream Mapping) Approach to Reduce

Satish Tyagi, Wayne State University, Department of Industrial & Systems Engg, Detroit, MI, 48202, United States of America, satish.tyagi@wayne.edu, Kai Yang

Main focus of is to exploit lean thinking to obtain product with improved technological innovation, performance and quality. VSM is used to explore wastes, inefficiencies, non-valued added steps in a single, definable process out of complete nPDP. A current state map was developed using Gemba walk. Further, brainstorming was conducted to explore wastes and root causes of all issues raised during process walk. It is expected that PD teams will reduce product definition time in nPDP by 50%.

3 - Multi-state Belief Probabilities Based Framework for CS Attributes Prioritization

Bimal Nepal, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, United States of America, nepal@tamu.edu, Michael Johnson, Om Prakash Yadav

This paper presents an analytic network process (ANP) based framework that allows decision makers to prioritize the CS attributes by considering not only the correlation among the attributes themselves but also the cross correlation among attributes and factors. Furthermore, the proposed framework employs Bayesian Belief Network (BBN) methodology with multi-state belief probabilities to deal with incomplete information during the early stages of product development.

4 - Gifts Versus Coupons: Science is the New Reality

Yuri Smirnov, Principal Scientist, FreeMonee Network, 411 Borel Ave., Suite 310, San Mateo, CA, 94402, United States of America, yuri.smirnov@freemonee.com, Andy Laursen

FreeMonee introduced a breakthrough consumer incentiveóthe FreeMonee Gift. As a customized cash incentive, a gift outperforms traditional marketing vehicles, including recently popularized online coupons. Success of FreeMonee Gifts is based on big data mining and sophisticated analytics. The patent-pending FreeMonee Gift Underwriting Engine leverages transactional purchase history to accurately predict redemptions, consumer spend and merchant ROIódelivering unprecedented results to market.

■ WC56

56- Curtis A- Hyatt

Emerging Topics in Technology Management

Sponsor: Technology Management

Sponsored Session

Chair: Leonardo Santiago, Federal University of Minas Gerais, Escola de Engenharia da UFMG, Av. Antonio Carlos, 6627. Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br

1 - Optimal Investment in Product Support and New Product Development in Pharmaceutical Industry

Zhili Tian, Assistant Professor, Towson University, 8000 York Rd, Towson, MD, 21252, United States of America, zhili.a.tian@gmail.com

A firm invests in the support of existing product and new product development. The first influences the adoption of the existing product while the second brings new product in the future market. The firm has to balance the investment in the two competing projects. We optimize the investment in these two types of projects. We estimate the new drug adoption model, which is a function of investment in different advertisement vehicles using drugs from Pfizer and the similar drugs in the market.

2 - Innovation Inside: An Analysis of Internal Idea Competitions in Two Large IT Companies

Sebastian Fixson, Babson College, Tomasso 226, Babson Park, MA, 02457, United States of America, sfixson@babson.edu

To generate innovations, idea competitions have grown in number and sophistication in recent years. In this paper, we study internal idea competitions in two large companies. We compare and contrast the choices the two companies have made regarding a set of decision variables in the design of their idea competitions, and how those choices impacted the outcome.

3 - The Impact of Sector Dynamic Rules on the Choice of Management Strategy in Highly Uncertain Market and Technology Situation

Olga Kokshagina, PhD Student, Centre for Scientific Management (CGS), CGS Mines ParisTech, 60 Boulevard Saint-Michel, Paris, 75272, France, olga.kokshagina@mines-paristech.fr, Pascal Le Masson, Patrick Cogez, Benoit Weil

Management strategy choice in high uncertainty is predefined by sector dynamics. There are sectors "pushed" by technology or "pulled" by market. But what happens in the situations when technology and markets are unknown (ex., semiconductors). Which strategy to adopt in these conditions? We create a simulation model to test the influence of different sector dynamics on the choice of management strategies. Our results show new strategies that minimize risks and exploration costs in double unknown.

4 - Network Structure, Time and Timing in Online Social Networks

Charles Weber, Associate Professor of Eng & Tech Mgmnt, Portland State University, P.O. Box 751 ETM, Portland, OR, 97207, United States of America, webercm@gmail.com, Nitin Mayande

An empirical study of connectivity in online social network has identified a link between network structure and the time and timing of information propagation. The findings of the study suggest that the timing of surges in network performance may be predictable.

5 - The Impact of Quality Exploration and Exploitation on Sustainable Production Systems

GraÁa Silva, Assistant Professor, ISEG, Rua do Quelhas, n.ſ 6, Lisbon, 1200-781, Portugal, gracamsilva@iseg.utl.pt, Paulo Gomes

We develop a model to explain how firm level quality exploration and quality exploitation capabilities impact sustainable production. The data come from ISO 9000 registered manufacturing firms. Structural equation modeling analyses show that while quality exploitation capabilities strongly influence sustainable production quality exploration has no impact. The findings also reveal that sustainable production contributes for enhancing operational performance.

■ WC57

57- Curtis B- Hyatt

Decision Support Systems I

Contributed Session

Chair: Mengmeng Chen, PhD Student, Iowa State University, Industrial and Manufacturing Systems Eng, 3004 Black Engineering, Ames, IA, 50011, United States of America, chenmm@iastate.edu

1 - A New Method for Managing Dynamic Inventory Based on GPS and GIS

hongbo li, IBM Research-China, Building 19 Zhongguancun Software Park, Beijing, China, hboli@cn.ibm.com, Hongwei Ding, Jin Dong, Wei Wang

For distribution centers, it's key to control the inventory reasonably, which should not only satisfy the re-quirement from clients in time but also avoid inventory backlog. We present a new method, which introduces the on-road freight position information to control the inventory using GPS and GIS. Therein, dynamic inventory is computed based on forecasting and network model in time, which can help to coordinate the inventory managers, salesmen and dispatchers to make scheduling effectively.

2 - Assistant Decision-Making System for Power Consumption Optimization based on Intelligent Evaluation

Wei Zhao, IBM Research-China, Diamond Building 19-A, Beijing, China, wzhaow@cn.ibm.com, Liang Zheng, Hai Rong Lv, Jin Feng, Jun Hua Ma, Jin Dong, Wen Jun Yin

With the rapid growth of industrial power consumption and cost, the demand on power consumption optimization becomes urgent for of enterprises and power companies. The paper deals with an assistant decision-making system for power consumption optimization. Based on multiple dimension evaluation model on Marketing and Load Control System information, it analyzes the optimization potential of power consumers and generates optimization suggestions of consumption mode.

3 - Decision Analysis of Data Mining Project: Insight from the National Inpatient Sample Database

Mengmeng Chen, Phd Student, Iowa State University, Industrial and Manufacturing Systems Eng, 3004 Black Engineering, Ames, IA, 50011, United States of America, chenmm@iastate.edu

This study aims to improve decision making in healthcare. We use data mining to learn how to predict outcomes of medical procedures. We pose two key research problems of investigating: to model best practices as the set of data points that are the most useful for accurately predicting medical outcomes, and interpret the selected instances to provide insights into best healthcare practices. This study is to inform decision making in a way that lead to both increased effectiveness and lower cost.

4 - Active Learning on Influence Diagrams

Ahren Lacy, Stanford University, 209 Running Farm Ln, Stanford, CA, 94305, United States of America, ahrenlacy@stanford.edu, Ross Shachter

Information gathering is an opportunity available in many decision contexts. We consider a setting where a decision maker can pay to sequentially query uncertainties and observe samples in an influence diagram, before committing to a decision. The novelty in our approach is in valuing active learning explicitly as a series of options. We will formulate a model of this setting and motivate solution methods.

■ WC58

58- Phoenix East- Hyatt

Stochastic Modeling in Health-care Applications

Sponsor: Applied Probability

Sponsored Session

Chair: Nilay Argon, University of North Carolina, Department of Statistics and OR, Chapel Hill, NC, United States of America, nilay@unc.edu

1 - Meeting Waiting Time Targets in Emergency Departments

Rene Bekker, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, Netherlands, r.bekker@vu.nl, Paulien Koeleman, Sandjai Bhulai

Timely access to Emergency Departments avoids patients abandoning and ambulance rerouting. The time window depends on levels of urgency and is decided upon during the triage process. At treatment completions, ED's must prioritize patient types with different level of urgency that comply with overall waiting time targets. Due to performance in terms of tail distributions of waiting times, such patient scheduling problems are complex. This is addressed by using new techniques in an MDP framework.

2 - Dynamic Patient Scheduling for Chemotherapy
Yasin Gocgun, Post Doctoral Fellow, Sauder School of Business, Operations and Logistics Division, Vancouver, BC, V6T 1Z2, Canada, yasin.gocgun@sauder.ubc.ca, Martin Puterman

We study a class of scheduling problems where patients arrive randomly and require appointments within a range of days that vary by patient type. These problems are motivated by our applied work in chemotherapy appointment scheduling. We formulate these problems as Markov Decision Processes and employ Approximate Dynamic Programming (ADP) to obtain good policies. Using simulation, we compare the ADP policies to easy-to-use heuristic decision rules under a range of scenarios.

3 - Dynamic Casualty Routing in the Aftermath of a Mass-casualty Event
Alex Mills, Indiana University Kelley School of Business, 1309 E. Tenth Street, Bloomington, IN, 47405, United States of America, millsaf@indiana.edu, Nilay Argon, Serhan Ziya

We develop a model for dynamic routing of a large number of casualties in the aftermath of a mass-casualty event. The casualties, who are distributed at multiple locations, require transportation to one of several collection points, where they wait to receive service (e.g., medical treatment or decontamination). We partially characterize the solution that maximizes the discounted throughput, and we develop effective heuristic policies.

4 - Triage or Not to Triage?
Zhankun Sun, University of North Carolina at Chapel Hill, Statistics and Operations Research, CB#3260, Chapel Hill, NC, 27514, United States of America, szk@unc.edu, Nilay Argon, Serhan Ziya

Inspired by the mass-casualty triage problem, we consider a clearing model with two customer types. Customer types are initially unknown but the server has the option of triaging the customers to obtain imperfect information on their types before serving them. With the objective of minimizing the total holding costs, we obtain analytical characterizations of optimal dynamic and static policies. For example, we prove that the optimal dynamic policy is of threshold type.

■ WC59

59- Phoenix West- Hyatt

Sequencing Problems and Bandit Applications

Sponsor: Applied Probability

Sponsored Session

Chair: David Brown, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, dbbrown@duke.edu

1 - Robust Control for the Multiarmed Bandit Problem
Felipe Caro, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu, Aparupa Das Gupta

We address the problem of uncertainty in the estimated transition probabilities for the Multiarmed Bandit problem. We define the equivalent to the Gittins index in the robust setting but we show that it is not always optimal. We propose a heuristic to solve the problem which is faster by a constant factor than the robust index policy evaluation.

2 - Sequential Screening: A Bayesian Dynamic Programming Analysis
Peter Frazier, Assistant Professor, Cornell University, 106 Burleigh Dr, Ithaca, NY, 14850, United States of America, pf98@cornell.edu, Li Chen, Bruno Jedynak

Sequential screening is the task of allocating simulation effort to identify those input factors having a significant effect on output. Using dynamic programming, we compute the Bayes-optimal method for splitting factors among groups within a sequential bifurcation procedure. We discuss cases in which existing group-splitting strategies are optimal, and other cases in which the optimal policy is substantially better than current practice.

3 - Optimal Sequential Exploration: Bandits, Clairvoyants and Wildcats
David Brown, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, dbbrown@duke.edu, Jim Smith

We consider the problem of sequentially exploring a large oil field. The problem resembles a classical bandit problem, but is complicated by dependence: results for one target provide information about neighboring targets. We develop heuristic policies by grouping targets into clusters that are assumed to be independent. We also show how to compute upper bounds using information relaxations and results for bandit superprocesses. In our examples, these heuristic policies are nearly optimal.

■ WC60

60- Remington- Hyatt

Airline Operations Recovery

Sponsor: Aviation Applications

Sponsored Session

Chair: Ameer Al-Salem, Associate Professor, Qatar University, Mechanical and Industrial Engineering, Doha, 2713, Qatar, ameer@qu.edu.qa

1 - Approximate Algorithms for Aircraft Rescheduling Problems under Operation Disruptions
Gulsah Hancerliogullari, PhD Student, Old Dominion University, 5115 Hampton Blvd. Kaufman Hall, Room 249, Norfolk, VA, 23529, United States of America, ghancerl@odu.edu, Ghaith Rabadi

Passenger satisfaction is one of the key considerations for airline companies that can be maximized by minimizing the number of cancellations and the total delay. In this study, aircraft reactive sequencing will be studied and schedule repair algorithms will be developed to deal with flight related disruptions, specifically, arrival of new aircraft, flight cancellations and aircraft delays due to unexpected events such as severe weather conditions, unexpected aircraft or personnel failures.

2 - Mathematical Model for Airline Flight Re-scheduling Problem under Disruptions
Mohamed Kharbeche, Postdoctoral Associate, Qatar University, Mechanical and Industrial Engineering, Doha, 2713, Qatar, mkharbec@qu.edu.qa, Ameer Al-Salem, Abdel Magid Hamouda, Fajr Ali Akbar Ansari, Sara Yousuf AL-Haidous, Nayla Ahmed Al-Thani

We propose airline re-scheduling model that simultaneously develop recovery plans by determining alternate flight schedules with a minimal change from original schedules. This model produces the optimal track, level and departure time for each flight of a schedule after a disruption. Computational results are investigated for this exact method.

3 - Aircraft and Passenger Recovery with Cruise Speed Control
M. Selim Akturk, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, akturk@bilkent.edu.tr, U. Arikan, Sinan Gurel

We present a new approach to solve the aircraft and passenger recovery problems simultaneously. We first formulate a nonlinear mixed integer model along with cruise speed and aircraft swapping decisions, which is second-order conic quadratic representable. Consequently, we could solve 97% of the realistic test problems optimally in less than one minute using a commercial MIP solver.

■ WC61

61- Russell- Hyatt

Decision Making in Homeland Security and Emergency Preparedness

Cluster: Applications in Emergency Management and Terrorism Security

Invited Session

Chair: Cameron MacKenzie, University of Oklahoma, 202 W Boyd St, Norman, OK, United States of America, cmackenzie@ou.edu

1 - Vulnerability Assessment of a Food Supply Chain to an Intentional Attack
Alan Erera, Professor, Georgia Institute of Technology, 765 Ferst Dr, Atlanta, GA, 30332, United States of America, alerera@isye.gatech.edu, Yanling Chang, Yu Zhang, Chelsea (Chip) White

We use a partially observed Markov game and a food supply chain process model to quantify the vulnerability of a food supply chain to contamination by an intelligent adversary using a chemical or biological agent. The objective is compare food supply chain designs based on both productivity and vulnerability.

2 - A Location Model for Storage of Emergency Supplies to Respond to Technological Accidents in Bogota

Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este #19A -40, Bogota, 00, 1111, Colombia, r.akhavan@uniandes.edu.co, Ridley Santiago Morales Mahecha

The Prevention and Attention of Emergencies Fund of Bogota requires the opening of new warehouses where supplies are stored to respond to different types of emergencies. We propose a linear optimization model connected with ArcGIS to determine the optimal location of these warehouses in order to minimize the total costs, subject to covering at least a certain percentage of the affected people with a fixed radius of coverage. Results are evaluated using a Monte Carlo simulation model.

3 - Comparing Investments in Hardening, Robustness and Recovery Against Intelligent Attacks

Sinan Tas, Assistant Professor, Pennsylvania State University-Berks, 1800 Broadcasting Road, Reading, PA, 19610, United States of America, sinantas@gmail.com, Vicki Bier

We have developed a game-theoretic model that can evaluate the resilience of an electric power system from intelligent attacks taking into account the impact of both cascading failure and system restoration. In this talk, we use our model to evaluate not only component hardening, but also investments in robustness (reducing the likelihood of cascading failure) and recovery (reducing component restoration times).

4 - Optimal Resource Allocation for Preparedness and Recovery of Interdependent Systems

Cameron MacKenzie, University of Oklahoma, 202 W Boyd St., Norman, OK, United States of America, cmackenzie@ou.edu, Kash Barker

Investing in infrastructure and industry sectors can lessen the direct impacts of disruptive events, and an input-output model can demonstrate how those direct impacts propagate to other economic sectors. We develop a model where the decision maker allocates resources to prepare for a disruption and to help individual industries recover if the disruption occurs. These models are applied to a case study to analyze the economic impacts of the Deepwater Horizon oil spill.

■ WC62

62- Borein A- Hyatt

Reliability I

Contributed Session

Chair: Luis Mejia Sanchez, ASU, 699 S Mill Ave, Tempe, AZ, United States of America, luis.mejia@asu.edu

1 - Statistical Analysis of Drop Shock Durability for Mobile Phone Displays

Suk Joo Bae, Professor, Hanyang University, 705-2 Engineering Center, 17 Haengdang-dong, Seongdong-gu, Seoul, 133-791, Korea, Republic of, sjbae@hanyang.ac.kr, Seongjoon Kim, Kyoungmin Kim, Minsu Kim

Drop shock durability of mobile phone displays has become an important issue for the industry because of the trend of larger and lighter devices in recent years. Especially, the mobile phone has a great variety of use conditions and a sudden shock that causes catastrophic damage to the display is inevitable during its usage. In this research, a systematic approach including standardized drop test method and statistical analysis to evaluate drop shock durability for mobile phone is presented.

2 - Integration of Reliability Information for a New Product

Luis Mejia Sanchez, Arizona State University, 699 S Mill Ave., Tempe, AZ, United States of America, luis.mejia@asu.edu, Rong Pan

We investigate different sources of reliability information to perform an assessment of the system reliability for a new product in the design environment. A graphical model is used to develop a methodology that depicts the integration of these sources of information which include limited testing, expert opinion and parent information. An example is presented to demonstrate the proposed methodology.

3 - System Reliability Optimization with Uncertain Stress Usage and Operating Condition Profile

Nida Chatwattanasiri, Rutgers University, Industrial & Systems Engineering, Piscataway, NJ, United States of America, nidac@eden.rutgers.edu, David Coit

The optimal redundancy allocation problem is developed for each subsystem of multiple component choices. A broad perspective is proposed to analyze uncertainty of actual system usage stresses. Sensitivity of component reliability occurs due to a relative variation of stress operating condition. The risk neutral & averse designs are considered for reliability model with probability associated with defined future usage conditions. The formulated problem is solved by nonlinear integer programming.

4 - A New Efficient Approach to Unbiased Estimation and Square Root Convergence Rate for SDEs

Chang-han Rhee, Stanford University, Huang Engineering Building, Stanford, CA, 94305, United States of America, chrhee@stanford.edu, Peter Glynn

We will introduce a new approach to constructing unbiased estimators for expectations of path functionals associated with stochastic differential equations(SDEs). Our randomization idea is closely related to multilevel Monte Carlo and provides a simple and efficient mechanism for constructing a finite variance unbiased estimator with "square root convergence rate" whenever one has available a scheme that produces strong error of order greater than 1/2 for the path functional under consideration.

■ WC64

64- Cowboy Artist- Hyatt

Maintenance and Warranty

Contributed Session

Chair: Raja Jayaraman, Assistant Professor, Khalifa University of Science Technology and Research, Department of Industrial & Systems Engg., Al Saada St. (19th) & 2nd Street, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae

1 - A Study of Maintenance in a Manufacturing System with Machine Breakdown Imperfect Production System

Liangpeng Chen, Mr, Department of ISE, National University of Singapore, Singpaore, Singapore, g0900408@nus.edu.sg, Boray Huang

This study develops an optimal maintenance policy in manufacturing systems under a generalized framework. We consider a production lot sizing problem in which the production facility is subject to both random failures and imperfect production. An integrated model is developed with the aim of minimizing undiscounted long run average cost. Bounds on the optimal maintenance policy are derived and a numerical example is given to illustrate the proposed procedure.

2 - A Single-machine Energy Efficient Maintenance and Production Planning Problem

Farnaz Ghazi Nezami, Wichita State University, 1845 Fairmount St., Wichita, KS, 67260, United States of America, fxghazinezami@wichita.edu, Mehmet B. Yildirim

Maintenance and production planning are two highly interrelated objectives. We propose a mathematical model to determine the best maintenance plan considering production scheduling constraints, energy consumption and reliability. Results are discussed through sensitivity analysis.

3 - Optimal Scheduling of Inspections in a Delay Time Model

Ji Ye Janet Sung, University of Toronto, 5 King's College Road, Toronto, On, M5S3G8, Canada, janet@mie.utoronto.ca

When a defect occurs in an asset, it may transition into a failure over time, known as delay time. These defects can be identified by taking measurements of the asset. The data from inspections is processed for use in decision support systems to justify maintenance activities. Given defects that arrive according to a non-homogeneous poisson process, we will develop a model to minimize the total cost of the maintenance policy.

4 - Sufficiency Model Action Clarification with Applications in Cyber Maintenance

Anthony Afful-Dadzie, The Ohio State University, 2100 Neil Ave., Columbus, OH, 43210, United States of America, afful-dadzie.1@buckeyemail.osu.edu, Soo Ho Lee, Theodore Allen

We propose a general framework for evaluating the readiness of available data to support Markov Decision Process policy development called Sufficiency Model Action Clarification (SMAC). We illustrate its usefulness for the important application of host maintenance decision-making to address known cyber vulnerabilities using real-world data which includes 3 actual attacks. The policy methods provide reliable prescription approaches for actions for specific hosts at the various levels.

5 - Pricing Warranty Policies for Heterogeneous Population

Raja Jayaraman, Assistant Professor, Khalifa University of Science Technology and Research, Department of Industrial & Systems Engg., Al Saada St. (19th) & 2nd Street, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae, Young Seon Jeong

Warranty models are often studied under the assumption that the product users are homogeneous. While this assumption is convenient for modeling purpose, in reality this is invalid. We present some new ideas to formulate and analyze warranty models capturing the heterogeneity aspect and its impact on pricing product warranties.

■ WC65

65- Cassidy-Hyatt

Applications of Data Mining II

Contributed Session

Chair: Adrian Albert, PhD Student, Stanford University, 350 Serra Mall, Stanford, Ca, 94305, United States of America, adalbert@stanford.edu

1 - Differentiating Root Causes of In-service Product Failures as Design Errors or Manufacturing Defects

Avishek Pal, University of Warwick, International Manufacturing Centre, Coventry, CV4 7AL, United Kingdom, Avishek.Pal@warwick.ac.uk, Darek Ceglarek

Diagnosing in-service failures as design errors or manufacturing/assembly defects is crucial for rapid improvement of quality problems in new products. This study applies data mining methods to localize failure root causes in fault-generating design parameters or process variables by integrating heterogeneous data and process models from different product lifecycle stages.

2 - Incorporating Predictors Based on Sequence Analysis Techniques in Bankruptcy Prediction Modeling

Andrey Volkov, PhD Student, Ghent University, Department of Marketing, Tweekerkenstraat 2, Ghent, 9000, Belgium, andrey.volkov@ugent.be, Dirk Van den Poel

This paper investigates the performance of the two novel predictors that capture the dynamics of the bankruptcy process expressed in the sequences of financial ratios: (1) predictors based on Markov for Discrimination, and (2) predictors based on clustering of similar sequences of financial ratios. The results show the superb performance of the novel predictors in terms of the 5-percent and 10-percent lift, when benchmarked with more traditional sequential and non-sequential predictors.

3 - What Your Neighbors Tell About You: Network Analysis to Predict Pre-release Weekly Box-office Revenue

Inbal Yahav, Assistant Professor, Bar Ilan University, Graduate School of Business, Ramat Gan, 52900, Israel, inbal.yahav@biu.ac.il

Predicting weekly boxoffice revenue is an important yet challenging problem. For retailers such information will enhance negotiation options with distributers, and assist in planning weekly movie portfolio mix. Existing literature focus on either forecasts of pre-release total gross revenue or on weekly predictions based on first weeks observations. Using information on similarity and competition network, this work expands previous research to also predict the peak revenues and sales horizon

4 - Financial Risk Estimation for Project Management

Anshul Sheopuri, IBM Research, IBM T. J. Watson Research Ctr, Hawthorne, NY, 10532, United States of America, sheopuri@us.ibm.com, Ta-shin Li, Rose Williams, Wesley Gifford

Several risk management techniques exist in the machine learning literature to estimate risk to enable portfolio management, for example, regressions, classification trees, hazard models, etc. However, these techniques have typically been used to manage a portfolio of loans, insurance products or customers. In this work, we describe a novel application to project management.

5 - You are How You Consume: Mining Structure in Energy Demand Data

Adrian Albert, PhD Student, Stanford University, 350 Serra Mall, Stanford, CA, 94305, United States of America, adalbert@stanford.edu, Ram Rajagopal

Demand variability leads to peak buildup and is costly to service. We recently proposed a technique to mine patterns from large sets of smart meter data that identifies recurring shapes in power demand distributions. We expose a large degree of structure in consumption and quantify how non-Gaussianity is associated with appliance stock, house characteristics, and occupant behaviors and attitudes. This is a first illustration of a data-driven tailoring of efficiency and demand-response programs.

■ WC66

66- Ellis West- Hyatt

Statistical Data Analysis for Manufacturing and Service System Design and Improvement

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qingyu William Yang, Assistant Professor, Wayne State University, 4815 Fourth Street, Rm 2167, Detroit, MI, 48335, United States of America, qyang@wayne.edu

1 - Designing Productive Assembly System Configuration Based on Hierarchical Subassembly Decomposition

Hui Wang, University of Michigan, Ann Arbor, MI, United States of America, huiwz@umich.edu

Fast development of energy systems entails a responsive and reconfigurable assembly system. This talk presents the assembly system design for energy products by considering relations among assembly hierarchy in product designs. A subassembly decomposition based method is proposed to address challenges in the reconfigurable system design including complex configuration design, system design for product family, and system configuration and reconfiguration considering stochastic product evolution.

2 - An Efficient Method for Uncertainty Quantification for Gear Life Prediction

Zhigang Tian, Concordia University, 1515 Ste. Catherine Street West, Montreal, Canada, tian@ciise.concordia.ca, Fuqiong Zhao

Uncertainty quantification in damage growth is critical in equipment health prognosis. In existing work, simulation is commonly used to account for the uncertainty in prognostics. In this paper, a stochastic collocation approach is developed for efficient integrated gear health prognosis, involving evaluating gear remaining useful life prediction uncertainty as well as the likelihood function in Bayesian inference. Examples are used to demonstrate that the proposed approach.

3 - Striving for Operational Availability: Investing in Reliability or Maintenance Logistics?

Nhi Mai, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, nm1178@txstate.edu, Rana Dawud, Jett Piechota, Tongdan Jin

Performance-based contracting aims to lower the asset ownership cost while ensuring the equipment operational availability goal. We present a multi-echelon, multi-item logistics supply chain solution that jointly optimizes the system reliability, spares stock level, and repair turn-around times. We further argue that the system operational availability can be warranted under a zero spares inventory policy provided the reliability is designed into early product phase.

■ WC67

67- Ellis East- Hyatt

Mathematical and Experimental Methods for Characterizing Nanocrystal Growth

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Chiwoo Park, Assistant Professor, Florida State University, 2525 Pottsdamer St., Tallahassee, FL, 32311, United States of America, cpark5@fsu.edu

1 - In Situ Liquid STEM for Observing, Controlling and Quantifying Individual Nanoparticle Growth

Nigel D. Browning, Scientist, Pacific Northwest National Lab, Environmental Molecular Sciences Laboratory, 3335 Q Avenue, Richland WA 99354, United States of America, Nigel.Browning@PNNL.Gov, James Evans

A key first step to studying transient processes in materials science, chemistry and biology is to control the environment around the sample. In this presentation, I will discuss the development and implementation of an in-situ liquid stage that permits atomic resolution imaging of samples in solution. The functionality of this stage has a wide range of applications including visualizing and quantifying the nucleation and growth of individual nanoparticles.

2 - Modeling Nanocrystal Growth with Ex-situ Data

Chiwoo Park, Assistant Professor, Florida State University, 2525 Pottsdamer St., Tallahassee, FL, 32311, United States of America, cpark5@fsu.edu

We present a nonparametric Bayesian model for analyzing the multi-modal growth of nanocrystals with ex-situ TEM image data in absence of in-situ observations. The model provides Bayesian estimation of multiple growth modes of nanocrystals. The estimation result was consistent with real nanocrystal growth trajectories in empirical studies.

■ WC68

68- Suite 312- Hyatt

Modeling and Computation in Financial Engineering

Sponsor: Financial Services Section

Sponsored Session

Chair: Ning Cai, Department of Industry Engineering and Logistics Management, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, ningcai@ust.hk

1 - Location, Location, Location! Asset Pricing Models with Spatial Interaction

Haowen Zhong, PhD Student, Columbia University, 500 West 120th Street, New York, NY, United States of America, hz2193@columbia.edu, Steven Kou, Xianhua Peng

Spatial interaction is important in modeling real estate assets. In this paper, we propose SCAPM and SAPT that extend the classical asset pricing models by incorporating spatial interaction among asset returns. Our models characterize the risk premiums of both ordinary assets and futures contracts in an economy with spatial interaction and show the influence of spatial interaction on risk premiums. Statistical inference procedures for the models are also derived and an empirical test is given.

2 - A Simple Expansion Formula for Local Volatility Model

Yingda Song, PhD Candidate, Hong Kong University of Science and Technology, Department of Industrial Engineering, Clear Water Bay, Kowloon, Hong Kong, Hong Kong-PRC, ysong@ust.hk, Ning Cai

This paper proposes a simple expansion formula for European options under local volatility model. The expansion series are given explicitly in terms of Black Scholes greeks. The convergence of the formula is justified both theoretically and numerically.

3 - A Two-sided Laplace Inversion Algorithm with Computable Error Bounds and its Applications in Financial Engineering

Steven Kou, Professor, Columbia University, 312 Mudd Building, Department of IEOR, New York, NY, 10027, United States of America, sk75@columbia.edu, Ning Cai

We propose an inversion algorithm for two-sided Laplace transforms with computable error bounds. The algorithm can achieve any desired accuracy. In many cases, the bounds decay exponentially, leading to fast computation. Therefore, the algorithm is especially suitable to provide benchmarks. Examples from financial engineering show that our algorithm is fast and easy to implement.

4 - Dynamic Mean-safety-First and Synamic mean-VaR Formulations

Duan Li, Chair Professor, Department of Systems Engineering & Engineering Management, The Chinese University of Hong Kong, Shatin, Hong Kong, Hong Kong-PRC, dli@se.cuhk.edu.hk, Ke Zhou

We report in this talk recent progress in investigating the relationship between the dynamic mean-safety-first and dynamic mean-VaR formulations. As the dynamic mean-VaR formulation is time inconsistent, or nonseparable in the sense of dynamic, we use the dynamic mean-safety-first as an auxiliary problem. We further study how to improve the investment policy to the dynamic mean-VaR formulation.

■ WC69

69- Suite 314- Hyatt

Risk in Portfolio Management

Cluster: Risk Management

Invited Session

Chair: Xuedong He, Assistant Professor, Columbia University, 316 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, xh2140@columbia.edu

1 - Buy Low, Sell High with Mutually Exciting Processes, Adverse Selection and Short-Term-Alpha

Sebastian Jaimungal, Associate Professor, University of Toronto, Department of Statistics, University of Toronto, 6005-100 St. George Street, Toronto, On, M5S 3G3, Canada, sebastian.jaimungal@utoronto.ca, Alvaro Cartea

We introduce a multi-factor mutally exciting process for market-making strategies which allows for feedback and clustering effects in market orders and the shape of the limit order book and also accounts for the adverse selection effect. We pose and solve the stochastic control problem for the market marker and show how the strategy outperforms (i) a Poisson model which does not account for clustering (ii) a model which does not distinguish between influential and non-influential events.

2 - A Multilevel Simulation Method to Portfolio Risk Measurement

Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong, Hong Kong-PRC, nchen@se.cuhk.edu.hk, Yanchu Liu

This paper proposes a Monte Carlo method to estimate various nolinear risk measures for financial portfolios. We present a multilevel scheme to resolve the tradeoff between the bias and the variance of the estimator. It shows that the complexity of our method is O(\epsilon^{-2} (log\epsilon)^2) in the cases of Lipschitz risk measures and O(\epsilon^{-7/3}) in the cases of loss probabilities and other non-smooth risk measures, if we require the target MSE to be less than \epsilon^2.

3 - Optimal Consumption and Investment with Asymmetric Long-term/Short-term Capital Gains Taxes

Min Dai, Associate Professor, National University of Singapore, Dept. of Math, Singapore, Singapore, matdm@nus.edu.sg, Yifei Zhong, Hong Liu

We propose an optimal consumption and investment model with asymmetric longterm/short-term tax rates. We also consider both the case where an investor can get full tax rebate for capital losses and the case where the investor can only carry over capital losses. We show that the optimal consumption and investment policy is qualitatively different from what is found in the standard literature.

4 - Modeling and Forecasting Mortality Rates

Daniel Mitchell, University of Texas, McCombs School of Business, 1 University Station, B6000, Austin, TX, 78712, United States of America, Daniel.Mitchell@phd.mccombs.utexas.edu, Patrick Brockett, Rafael Mendoza, Kumar Muthuraman

We propose a model that expresses log mortality rate changes as an age group dependent linear transformation of a mortality index. The mortality index is modeled as a Normal Inverse Gaussian. We demonstrate, with an exhaustive set of experiments and data sets spanning 11 countries over 100 years, that the proposed model significantly out performs existing models.

■ WC70

70- Suite 316- Hyatt

Recommender Systems

Sponsor: Information Systems

Sponsored Session

Chair: Jingjing Zhang, Indiana University, Kelley School of Business, Bloomington, IN, United States of America, jjzhang@indiana.edu

1 - Feedback Models inTop-N News Recommender Systems

Balaji Padmanabhan, Associate Professor, University of South Florida, 4202 E. Fowler Avenue, Tampa, FL, United States of America, bp@usf.edu, Shankar Prawesh

In prior work we highlighted problems with conventional Top-N news recommenders and presented a probabilistic alternative. Here we introduce a new class of recommendation techniques with feedback and discuss various properties of it both analytically and through simulations. Urn models from probability theory have been used to discuss the various properties of the proposed recommendation mechanism in a special case.

2 - Impact of Inventory on Recommender Systems

Emre Demirezen, PhD Candidate, Mays Business School, Texas A&M University, College Station, TX, 77843, United States of America, edemirezen@mays.tamu.edu

We consider a subscription based rental setting where satisfaction of customers depends on the availability of requested products. Hence, it is important for the firms to satisfy as much demand as possible. Recommender systems are typically used to help customers that suit their tastes best. However, they can be utilized to shift demand among products by considering inventory levels, and future demand and returns. We address this issue and present several useful managerial insights.

3 - Association Rules for Recommendations with Multiple Items

Abhijeet Ghosal, University of Minnesota, Minneapolis, MN, United States of America, abhijeet@umn.edu, Sumit Sarkar

We propose new association rules, termed disjunctive consequent rules that maximize the probability of selecting at least one of the recommended items and are more suitable for recommending items in online environments. An algorithm to mine such rules is developed which uses several properties of the problem to prune the search space while mining such rules. Experiments show that using disjunctive consequent rules provides more accurate recommendations than using conjunctive rules.

■ WC71

71- Suite 318- Hyatt

Applications in Information Systems

Contributed Session

Chair: Xiahua(Anny) Wei, Department of Economics, University of California, San Diego, 9500 Gilman Drive, La Jolla, Ca, 92093, United States of America, xiwei@ucsd.edu

1 - The Role of IT in Physician Employment

Sandra Vannoy, Assistant Professor, Appalachian State University, 416 Howard Street, 2106 Raley Hall, Boone, NC, 28608, United States of America, vannoysa@appstate.edu, Robert Johnston

Findings of a meta-analysis of literature show an unexpected effect of technologically-enabled health care reform in the U.S.: physicians are increasingly moving away from independent practice toward health care system employment due to issues associated with affordability, education, standards and maintenance of electronic medical record systems.

2 - Motivating Contributions to Online Knowledge Communities: Virtual Rewards and Reputation

Xiahua(Anny) Wei, Department of Economics, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, xiwei@ucsd.edu, Wei Chen

Online communities are important for external innovations. The success depends on attracting voluntary contributions of members. In this study, we investigate the effects of two motivating mechanisms, virtual rewards and reputation, on community contributions. By analyzing panel data from StackExchange.com, we find that these two mechanisms have positive effects on both the quantity and quality of user contributions. Our results provide important implications for theory and managerial practice.

■ WC72

72- Suite 322- Hyatt

Vehicle Routing Problems II

Contributed Session

Chair: Avijit Sarkar, Associate Professor, University of Redlands, 1200 E. Colton Avenue, Redlands, CA, 92373, United States of America, avijit_sarkar@redlands.edu

1 - A Vehicle Routing Problem with Leg Length Constraints and Stop Nodes

Leonardo Berbotto, University Carlos III of Madrid, Avda. Madrid 126, Getafe, 28903, Spain, lberbott@est-econ.uc3m.es, Sergio Garcìa Quiles, Francisco J. Nogales

The Vehicle Routing Problem (VRP) is one of the most classical combinatorial optimization problems. Here, we study a variant of the VRP that we call VRP with stop nodes where we introduce leg length constraints: no route leg can exceed a given amount (in distance or time) without making a stop at a stop node. Thus, these nodes must be visited in order to avoid the violation of these constraints. We will give a mathematical formulation for this model and we will show a first computational study.

2 - A Multi-round Approach using SimuRoute for Solving the Heterogeneous Vehicle Routing Problem

Javier Faulin, Professor, Public University of Navarre, Dept. Statistics and OR, Los Magnolios Bdg- 1st floor, Pamplona, 31006, Spain, javier.faulin@unavarra.es, Alba Agustin, Angel Juan, Scott Grasman, Alejandro G. del Valle

We propose a Multi-Round approach to solve the Heterogeneous Vehicle Routing Problem (HVRP). In each iteration, our approach solves the Capacitated Vehicle Routing Problem (CVRP) for the non-served nodes using the SimuRoute Procedure via Generalized Clarke and Wright (SR-GCW). Thus, the best routes which are generated from the CVRP solution are saved as a partial solution for the HVRP. Finally, competitive results have been obtained in reasonable computing times.

3 - Contributions of GIS in Vehicle Routing

Avijit Sarkar, Associate Professor, University of Redlands, 1200 E. Colton Avenue, Redlands, CA, 92373, United States of America, avijit_sarkar@redlands.edu, Hindupur Ramakrishna

Due to their inherently spatial nature, vehicle routing problems (VRPs) are increasingly being solved in geospatially assisted environments. This work investigates aspects of the usage of geographic information systems (GIS) to solve the VRP and its variants using two approaches – a thorough empirical analysis of the literature to identify trends, and an experimental design approach. The efficacy of both approaches and findings regarding value addition by GIS to solve the VRP are compared.

4 - Hybrid Large Neighborhood Search for the Bus Rapid Transit Route Design Problem

Verena Schmid, Departmento de Ingenerìa Industrial, Universidad de los Andes, Bogotá, Colombia, verena.schmid@univie.ac.at, Andrès L. Medaglia

Bus Rapid Transit Systems increase in popularity in urban transportation. The Bus Rapid Transit Route Design Problem (BRTDP) consists of finding a set of routes, such that the passengers' total travel time is minimized. Furthermore, using a given fleet of busses, frequencies for those routes need to be determined, while satisfying the demand of passengers and obeying capacity limitations within individual busses and stations. We propose a hybrid large neighborhood search metaheuristic to solve the problem at hand. Competitive results can be achieved for both single and multiple corridor instances.

■ WC73

73- Suite 324- Hyatt

Scheduling for Single and Parallel Machines

Contributed Session

Chair: Sinan Gurel, Assistant Professor, Middle East Technical University, Industrial Engineering Department, Ankara, 06800, Turkey, sgurel@ie.metu.edu.tr

1 - Single Machine Scheduling with Interfering Job Sets

Ketan Khowala, Arizona State University, 3612 Flora Vista Ave., Santa Clara, CA, 95051, United States of America, ketan.khowala@asu.edu, John Fowler, Hari Balasubramanian, Ahmet Keha

We developed heuristics that combines intuitions from simple rules like SPT, WSPT, EDD, etc to generate near optimal non dominated solutions sets for two different NP-Hard single machine scheduling problems with interfering job sets. The jobs belonging to either of two different disjoint sets have performance measures like: total completion time, number of tardy jobs, total weighted completion time and maximum lateness.

2 - Approximation Algorithms for Min-Sum Single-Machine Scheduling Problems

Maurice Cheung, Cornell University, 206 Rhodes Hall, Ithaca, NY, United States of America, myc26@cornell.edu, David Shmoys

We consider the single-machine scheduling problem where each job j has processing time p(j), and an arbitrary non-decreasing, non-negative cost function f(j,t) specifying the cost of finishing j at time t; the objective is to minimize the total cost. We give a simple primal-dual algorithm that yields, for any $c > 2$, a c-approximation algorithm for this problem. We also generalize this result for the setting where the machine's speed varies over time arbitrarily.

3 - A Bicriteria Rescheduling Problem with Controllable Processing Times

Sinan Gurel, Assistant Professor, Middle East Technical University, Industrial Engineering Department, Ankara, 06800, Turkey, sgurel@ie.metu.edu.tr, Derya Cincioglu

Rescheduling often involves replanning processing times of jobs. Compressing processing times helps to recover a schedule from a disruption but results higher manufacturing costs. We consider a parallel machine rescheduling problem with two objectives: number of disrupted jobs, i.e. the number of jobs that complete later than the original schedule, and manufacturing cost. We provide a mathematical model and propose a heuristic algorithm which generates approximate efficient solutions.

Wednesday, 3:20pm - 4:50pm

■ WD01

01- West 101- CC

Large Scale Combinatorial Optimization in Production and Logisitics

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Zhe Liang, Assistant Professor, Peking University, Chengfu Rd. 298 Founder Building 608, Beijing, 100871, China, liangzhe@coe.pku.edu.cn

1 - A Rotation-Tour Network Model for the Robust Aircraft Maintenance Routing Problem

Zhe Liang, Assistant Professor, Peking University, Chengfu Rd. 298 Founder Building 608, Beijing, 100871, China, liangzhe@coe.pku.edu.cn

In this talk, we present a rotation-tour based model for the robust aircraft maintenance routing problem. The robustness of solution is improved by making the routes go through a buffer connection when the accumulated risk reaches some criterion. The computational results show that the proposed model can be solved in reasonable time for all real-life test cases. The simulation results show that the robust aircraft maintenance solutions improve the average on-time rate of the test cases by 3%.

2 - Wind Driven Optimization for Scheduling

Kaan Kuzu, Assistant Professor, University of Wisconsin-Milwaukee, Lubar Hall S485, P.O.Box 742, Milwaukee, WI, 53201-0742, United States of America, kuzu@uwm.edu, Zikri Bayraktar

We introduce a new type of nature-inspired global optimization methodology, Wind Driven Optimization (WDO), based on atmospheric motion. The proposed technique is a population based iterative global optimization algorithm for multi-dimensional and multi-modal problems with the ability to implement constraints on the search domain. We apply the methodology to real world problems and compare its performance with the performance of other nature-inspired methodologies.

3 - Radiation Therapy Treatment Planning and Optimization for VMAT

Jie Song, Assistant Professor, Peking University, China, songjie@coe.pku.edu.cn, Bofei Sun

The latest radiation therapy technique VMAT is more complex than the well-studied IMRT, making the treatment planning problem more difficult. We study the treatment planning optimization problem for VMAT. We consider the dose optimization and MLC leaf patterns, and propose mixed-integer programming model and use Nested-Partition method to solve the problem.

■ WD02

02- West 102 A- CC

Joint Session DAS/MAS: Game Theory and Homeland Security II

Sponsor: Decision Analysis & Military Applications

Sponsored Session

Chair: Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

Co-Chair: Xiaojun Shan, University at Buffalo, The State University of New York, 435 Bell Hall, Buffalo, NY, 14260, United States of America, xshan@buffalo.edu

1 - A Model of Terrorism and Counter Terrorism Expenditure

Peiqiu Guan, PhD Student, University at Buffalo, Department of Industrial Engineering, 435 Bell Hall, Buffalo, NY, 14260-2050, United States of America, peiqiugu@buffalo.edu, Jun Zhuang, Stephen Hora

This research studies a game theoretic resource allocation problem under the budget limitation for both governments and terrorists. Our results show that the possibility of attaching multiple targets brings higher payoff to the terrorists and higher damage to the governments. Regression analysis suggests that the terrorist's strategy depends on both government and the terrorist's target valuation, while the government strategy only depends on the government target valuation.

2 - On the Robustness of Secrecy and Exposure of Defense System in Defender-attacker Games

Mohammad Nikoofal, PhD Student, McGill University, 1001 Sherbrooke Street West, Desautels Faculty of Management, Montreal, QC, H3A1G5, Canada, mohammad.nikoofal@mail.mcgill.ca, Jun Zhuang

It is commonly accepted in literature that, when facing a strategic terrorist, the government can be better off by manipulating the terrorist's target selection through exposing her defense system. But, the impact of terrorist's private information may significantly affect the government's first-mover advantage. In this paper, we compare the robustness of the defense equilibrium against the uncertainty in terrorist's valuation of targets in a sequential game with that in a simultaneous game.

3 - Cumulative Defensive Resource Allocation Among Multiple Targets in the Face of a Strategic Attacker

Xiaojun Shan, University at Buffalo, The State University of New York, 435 Bell Hall, Buffalo, NY, 14260, United States of America, xshan@buffalo.edu, Jun Zhuang

We study defensive resource allocation in a multi-period multi-target attacker-defender game. At each period, the defender allocates a limited amount of defensive resources over n targets and the attacker chooses one target to attack with some probability. We find that carry-over defense could have a significant effect on optimal allocations. The defender would prefer to defend more targets in the next period.

4 - A Graph Patrol Problem with Overlook

Kyle Lin, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd, Monterey, CA, 93943, United States of America, kylin@nps.edu, Michael Atkinson, Tim Chung, Kevin Glazebrook

A patroller traverses the graph through edges to detect potential attacks at nodes. To design a patrol policy, the patroller needs to take into account not only the graph structure, but also the different attack time distributions and different overlook probabilities at different nodes. We consider both random attackers and strategic attackers, and develop index-based heuristics.

5 - Import Security: Assessing the Risks of Imported Food

Vicki Bier, Professor, University of Wisconsin, 1513 University Avenue, Room 3270A, Madison, WI, 53706, United States of America, bier@engr.wisc.edu, Jonathan Welburn

There is rising concern for risks associated with imported foods. We use import violations data from the FDA Operational and Administrative System for Import Support (OASIS) to address these concerns. We quantify risks by both product type and country of origin, and explore the usefulness of OASIS data for risk quantification.

■ WD03

03- West 102 B- CC

Robust Ordinal Regression: State of the Art

Sponsor: Decision Analysis

Sponsored Session

Chair: Johannes Siebert, Akademischer Rat, University of Bayreuth, Universitatsstr. 30, Bayreuth, 95440, Germany, johannes.siebert@uni-bayreuth.de

1 - Robust Ordinal Regression Approach to MCDA: Principles and State of the Art

Roman Slowinski, Professor, Poznan University of Technology, 60-965 Poznan, Poznan, Poland, roman.slowinski@cs.put.poznan.pl, Salvatore Greco, Vincent Mousseau

Robust Ordinal Regression (ROR) finds a whole set of value functions compatible with preference information supplied by a Decision Maker (DM) in terms of pairwise comparisons of some alternatives, and applies this set on a considered set of alternatives. In result, ROR gets two preference relations: necessary and possible, corresponding to preferences holding for all or for at least one compatible value function. We present basic principles as well as a state of the art of ROR applied to MCDA.

2 - Value-focused Thinking and Robust Ordinal Regression: using the DMs Cognitive Abilities Effectively

Johannes Siebert, Akademischer Rat, University of Bayreuth, Universitatsstr. 30, Bayreuth, 95440, Germany, johannes.siebert@uni-bayreuth.de, Roman Slowinski, Salvatore Greco

Decision Makers (DMs) usually focus their cognitive effort on the evaluation of alternatives. Keeney (1992) postulates that DMs should start with their values and objectives to create systematically better alternatives. Robust Ordinal Regression uses holistic pairwise comparisons as an effective method to elicitate the DMs preferences. The choice of an internship exemplifies how students can use their cognitive abilities effectively by creating better alternatives and evaluating them easily.

3 - Interacting Criteria in Robust Ordinal Regression

Salvatore Greco, Professor, University of Catania, Corso Italia 55, Catania, 95129, Italy, salgreco@unict.it, Vincent Mousseau, Johannes Siebert, Roman Slowinski

We present new ways of handling interactions among criteria, which is a challenging problem in MCDA. They are based on Robust Ordinal Regression (ROR) where the classical MAUT additive value function has been augmented by two components: "bonus" and "penalty" values for (mutually exclusive) positively and negatively interacting pairs of criteria, respectively. Two ROR methods are presented: UTAGMS-INT, able to handle unipolar interactions, and UTA^GSS, able to handle bipolar interactions.

■ WD04

04- West 102 C- CC

Applications of Dynamic Programming and Control

Contributed Session

Chair: Sudhakar Achath, Professor, Amrita School of Business, Amrita Vishwa Vidyapeetham, Coimbatore, 641112, India, s.m.achath@gmail.com

1 - Adaptive Relaxed Linear Programming Formulation of ADP for Multi-item Inventory Problems

Maite Pena-Alcaraz, PhD Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-235, Cambridge, MA, 02139, United States of America, maitepa@mit.edu, Mort Webster

We present an Adaptive Relaxed Linear Programming approach (ARLP) of Approximate Dynamic Programming (ADP) to solve multi-item inventory problems. We compare the results with those obtained using Relaxed Linear Programming and different ADP algorithms. We show that the performance of the ARLP compared to other algorithms improves as the size of the problem increases.

2 - From the Optimizing Thermostat to the Smart Energy Management System

Yong Liang, PhD Candidate, University of California-Berkeley, Etcheverry Hall 1117, Berkeley, CA, United States of America, yongliang@berkeley.edu, Z. Max Shen

In this talk, we consider the case in which dynamic pricing will be offered to the Smart Grid users and the Energy Management System in each building/household makes the optimal energy usage, storage, and trading decisions based on the preference of users. We starts by introducing the design of a thermostat that optimally trades off comfort for cost saving, and extend to the model of a full-spectrum energy management system.

3 - Transshipment and Rebalancing Policies for Library Books

Gerlach van der Heide, PhD, University of Groningen, Nettelbosje 2, Groningen, 9747AE, Netherlands, g.van.der.heide@rug.nl, Kees Jan Roodbergen

Libraries transship books between locations to meet online customer requests, and rebalance the books after return. This research determines cost-minimizing decisions for transshipments and rebalancing. We consider a general policy in which we rebalance books in anticipation of demand. By means of stochastic dynamic programming, we derive the optimal policy for small instances. For larger instances we present a near-optimal heuristic that significantly outperforms current practice.

4 - Scheduling for Charging Plug-in Hybrid Electric Vehicles: A Dynamic Programming Approach

Feng Pan, Los Alamos National Lab, Los Alamos National Lab, Los Alamos, NM, 87545, United States of America, fpan@lanl.gov, Yunjian Xu

We consider a system with a finite number of PHEVs and an underlying power grid. The battery charging of multiple PHEVs is scheduled to maximize the overall social welfare, including. Through a dynamic programming formulation, we discuss the Less Laxity and Longer remaining Processing time (LLLP) principle and introduce various forms of improved polices generated from a given heuristic policy according to the LLLP principle.

5 - Modeling Investment Planning for Thermal Power Generation in India using Optimal Control Methods

Sudhakar Achath, Professor, Amrita School of Business, Amrita Vishwa Vidyapeetham, Coimbatore, 641112, India, s.m.achath@gmail.com

Using linear quadratic control with learning, this study formulates an optimal plan for investments in plant capacity, R&D expenditure and imported technology for the Indian thermal power sector. The modelling system has twelve linear equations and the control problem formulated in state-space is solved as a dynamic programming problem using Lagrange multipliers and a backward solution method, following Chow (1975). The problem was initially written in BASIC but later resolved in open-source R.

■ WD05

05- West 103 A- CC

Maintenance Optimization

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Hao Peng, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612WN, Netherlands, h.peng@tue.nl

1 - Determining the Optimal Preventive Maintenance Age under Uncertainty in the Lifetime Distribution

Bram de Jonge, University of Groningen, Faculty of Economics and Business, Department of Operations, P.O. Box 800, Groningen, 9700AV, Netherlands, B.de.Jonge@rug.nl, Warse Klingenberg, Ruud Teunter, Tiedo Tinga

The problem of determining the optimal maintenance age of a component given its lifetime distribution has been studied extensively. However, in practice, this lifetime distribution is not known with certainty. The uncertainty in the lifetime distribution is of interest because it influences the optimal maintenance age, implying that taking into account this uncertainty results in lower expected costs. We study the effect of uncertainty in the lifetime distribution on the optimal maintenance age.

2 - Inspection Policies under Delay Times and Postponed Replacements

C.D van Oosterom, PhD Student, Eindhoven University of Technology, P.O. Box 513, Opwettensemolen 62, Eindhoven, 5600MB, Netherlands, C.D.v.Oosterom@tue.nl, Geert-Jan van Houtum, Alaa Elwany, Dilay Çelebi

We develop a delay time model for a single-component system under a novel assumption: postponed replacement. If an inspection reveals a defect, we allow replacement to be postponed to provide a larger time window to prepare maintenance resources and increase utilization of the system's useful life. We derive the optimal policy for a system with exponentially distributed defect arrival time and deterministic delay time. By a numerical case study we evaluate the benefits of postponement.

■ WD07

07- West 104 A- CC

Theoretical Methods in Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Kobi Abayomi, Assistant Professor, Binghamton University, Environmental Studies, Math and Stat, Binghamton, NY, United States of America, Kobi@math.binghamton.edu

1 - Multivariate Extreme Value Thresholding

Matthew Lacer, Graduate Student, Georgia Institute of Technology, ISYE, 755 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, mvlacer@gatech.edu

Extreme Value Thresholding is the partitioning of data into regular and extreme valued for distribution fitting. In one dimension this entails setting a quantile cutoff for the Extreme Value Distribution; in higher dimension this involves fitting a Multivariate EVD to a k-dim quantile. We explore two approaches for the thresholding: multivariate Pickands (L-infinity) distance and multivariate Copula (f-divergence) distances and illustrate the methodology on multivariate environmental hazard data.

2 - Machine Learning and Algebraic Geometry for Network Data

Ian Dinwoodie, Assistant Professor, Portland State Universitty, P.O. Box 751, Portland, OR, United States of America, Ihd@pdx.edu

Understanding interactions and steady states for biological networks from data of multivariate time series requires a range of statistical and mathematical tools. Dimension reduction, machine learning, and algebraic geometry together can be used for practical questions of node dependence and exclusion from basins of attraction.

3 - Social TV Recommendation System

Shawndra Hill, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19103, United States of America, shawndra@wharton.upenn.edu, Adrian Benton

The approach that we have developed introduces a novel use of social media text for product recommendations, in this case, television show recommendations. We compare our approach to commonly used recommendation systems and show how one might combine the approaches to outperform any alone.

■ WD08

08- West 104 B- CC

Applications of OR/MS in Voting and Election Processes

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Michael Fry, Associate Professor, University of Cincinnati, 532 Lindner Hall, Carl H. Lindner College of Business, Cincinnati, OH, 45221, United States of America, mike.fry@uc.edu

Co-Chair: Muer Yang, Assistant Professor, University of St. Thomas, 1000 LaSalle Avenue, SCH 435, Minneapolis, MN, 55403, United States of America, yangmuer@stthomas.edu

1 - Robust Voting Machine Allocations

Muer Yang, Assistant Professor, University of St. Thomas, 1000 LaSalle Avenue, SCH 435, Minneapolis, MN, 55403, United States of America, yangmuer@stthomas.edu, Nuo Xu, Xinfang Wang

Recent US elections have experienced long and unequal queues resulted from poor voting machine allocations. Assigning voting machines to precincts must be completed months in advance of an election when there is significant uncertainty regarding total voter turnout, timing of voter arrivals, and time to complete a ballot. We develop a robust optimization model to allocate voting machines efficiently in the presence of such uncertainty.

2 - Efficient Algorithms for Assessing Contiguity and Holes in Political Districting

Douglas King, PhD Candidate, University of Illinois at Urbana-Champaign, Industrial and Enterprise Systems Eng., Urbana, IL, 61801, United States of America, kingdouglasm@gmail.com, Edward Sewell, Sheldon Jacobson, Wendy Cho

Political districting is an intractable problem with significant ramifications for political representation. This problem can be formulated as a graph partitioning problem; satisfying contiguity constraints can require significant computation as the problem size grows. This talk discusses a scale-invariant algorithm for enforcing contiguity in local search approaches to political districting.

3 - Fair Workload Allocation Problems using Simulation Optimization

Theodore Allen, Associate Professor, The Ohio State University, 1971 Neil Ave., Columbus, 43210, United States of America, Allen.515@osu.edu, Melissa Pizarro

Allocating limited resources across parallel subsystems is relevant to voting machine allocation and health care resource provisioning. With large numbers of subsystems, efficient discrete event simulation evaluations are computationally difficult but could, conceivably, aid in accurate evaluation of performance. We examine and describe the basic framework for these results which permits rigorous, accurate, and fair allocation focusing on voting machine allocation applications.

4 - Who Will Control the United States Senate after the 2012 Election?

Sheldon Jacobson, Professor, University of Illinois, 201 N. Goodwin Avenue (MC258), Urbana, IL, 61801, United States of America, shj@illinois.edu, Edward Sewell, Jason Sauppe, Steve Rigdon

Control of the United States Senate by a party provides critical legislative advantages. This presentation discusses an analytics approach to assessing who will achieve this objective. Forecasts for the 2012 Senate race are discussed. A web site electionanalytics.cs.illinois.edu has been created for people to follow these forecasts until election day.

■ WD09

09- West 105 A- CC

Trends in Multi-criteria Decision Analysis Applications

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: K.Nadia Papamichail, Senior Lecturer, Manchester Business School, Booth Street East, Manchester, M15 6PB, United Kingdom, nadia.papamichail@mbs.ac.uk

1 - Explanation Systems

K. Nadia Papamichail, Senior Lecturer, Manchester Business School, Booth Street East, Manchester, M15 6PB, United Kingdom, nadia.papamichail@mbs.ac.uk

This paper reviews explanation systems for multi-criteria decision problems. It presents an explanation system that justifies choices in emergency management. Explanation facilities add transparency into the way that value-based choices are computed. They describe what a system does, and justify why the system's recommendations are reasonable. The paper concludes with a discussion of future trends.

2 - Some Solutions for Baseball Manager's Problems

Marina Polyashuk, Associate Professor of Mathematics, Northeastern Illinois University, 5500 N. St. Louis Ave., Chicago, IL, 60625, United States of America, M-Polyashuk@neiu.edu

This paper focuses on several decision making situations facing a Major League Baseball (MLB) team manager in his everyday work: selection of the 9-player set for a batting lineup on any given game day, deciding on the batting order, and selecting a substitute player while a game is in progress. In order to offer decision making tools for solving these problems, we will apply multiple criteria methods, graph theory, and statistical analyses.

3 - A Multiple Perspectives Approach to Supplier Selection

Sharon Ordoobadi, Associate Professor, University of Massachusetts, 285 Old Westport Road, N. Dartmouth, MA, 02747, United States of America, sordoobadi@umassd.edu, Shouhong Wang

Using a single model for supplier selection could lead to a biased decision given the fact that any model has its limitations. The qualities of the decision making process and the decision itself increase by applying a multiple perspectives approach. The multiple perspectives decision making allows collaboration and knowledge sharing among the participants which leads to a less biased decision. This study proposes a framework of multiple perspectives decision making.

4 - Scenario Planning and Goal Programming

Theodor Stewart, Emeritus Professor of Statistical Sciences, University of Cape Town, South Africa, Theodor.Stewart@uct.ac.za

Recently, we have sought to integrate scenario planning and MCDA approaches by means of the concept of metacriteria, referring to performance measures according to different criteria within distinct scenarios. We now seek to apply this basic approach to goal programming models, with the aim of generating policies which are satisficing in terms of both objectives and scenarios. Practicalities of implementation both algorithmically and in terms of user judgements will be discussed.

5 - Multiobjective Optimization in Wastewater Treatment with PAINT and IND-NIMBUS Software Framework

Markus E Hartikainen, Postdoctoral researcher, Department of Mathematical Information Technology, University of Jyvaskyla, Jyvaskyla, Finland, markus.e.hartikainen@jyu.fi, Vesa Ojalehto, Kristian Sahlstedt, Kaisa Miettinen

We describe how a newly developed PAINT module of the IND-NIMBUS software framework can be used in multiobjective design of a wastewater treatment plant. The PAINT module allows the decision maker to interactively explore the Pareto front approximation constructed. Decision making with the approximation is computationally inexpensive. The decision maker can conveniently find preferred solutions (without computing delays) to the originally computationally costly simulator-based design problem.

■ WD10

10- West 105 B- CC

Stochastic Programming Models for Biofuel Supply Chains

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Sandra Eksioglu, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, sde47@ise.msstate.edu

1 - Carbon Constrained Supply Chain Network Design under Uncertainty

Mohammad Marufuzzaman, Research Assistant, Mississippi State University, P.O. Box 9542, Industrial and Systems, Engineering Starkville, MS, 39762, United States of America, maruf237@gmail.com, Sandra Eksioglu

This study shows the impact of different carbon regulatory policies on the design and management of a biofuel supply chain network in an uncertain environment. A two stage stochastic programming model is proposed for this problem. The model is solved using a modified L-shaped algorithm.

2 - Resilience in Managing Biofuel Infrastructure Systems under Seismic Hazards

Yongxi Huang, Assistant Professor, Clemson University, 314 Lowry Hall, Clemson, SC, 29634, United States of America, yxhuang@clemson.edu, Weichiang Pang

This study presents an approach that has explicitly considered the effects of seismic hazards in biofuel supply chain design. A quantitative assessment framework of resilience, measured by system performance impact and recovery effort, has been integrated into the stochastic modeling framework for disruption risk. A case study of biofuel infrastructure system planning in California shows that with this resilience design the system becomes more resilience and cost effective under seismic risk.

3 - Optimal Transportation Fuel Portfolio Design under Uncertain Technology Growth

Yuche Chen, University of California, Department of Civil and Env. Eng., Davis, CA, 95616, United States of America, ychchen@ucdavis.edu, Yueyue Fan

This study focuses on designing an optimal portfolio of liquid transportation fuels, subject to resource, environmental, and technological constraints. Cellulosic ethanol technology growth is treated as the main source of uncertainty and modeled explicitly in a stochastic programming framework. The model is used to evaluate the least-cost fuel portfolio that complies with the Low Carbon Fuel Standard, and the expansion pattern of cellulosic ethanol industry to support the optimal fuel pathway.

■ WD11

11- West 105 C- CC

Optimization: Nonlinear Programming

Contributed Session

Chair: Roummel Marcia, University of California, Merced, 5200 N. Lake Road, Merced, CA, 95340, United States of America, rmarcia@ucmerced.edu

1 - Dynamic Programming Applied to the Evaluation of Hydro Plants Firm Energy

David Yagi, Federal University of Juiz de Fora, Campus UFJF, Juiz de Fora, Brazil, davidyagi@yahoo.com, Rafael Brandi, Bruno Dias, Tales Ramos, Joao Passos Filho, Andrè Marcato, Ivo Silva Junior

This paper presents a new computational model that represents a non-linear formulation to optimize the evaluation of the firm energy associated to all hydroelectric plants belonging to the Brazilian Interconnected System. This problem was solved using dual deterministic dynamic programming and has used a historical scenario with 70 years of monthly inflows into each plant.

2 - An Application of Derivative-Free Optimization to Protein Cavity Comparison

Ruobing Chen, Lehigh University, 200 W Packer Ave., Bethlehem, PA, 18015, United States of America, ruc310@lehigh.edu, Katya Scheinberg, Brian Chen

In Structural Bio-informatics, accurate volumetric comparison of protein cavities can be achieved by optimizing the alignment of proteins, where the objective function requires a complex noisy simulation. In this paper, we propose a model-based trust-region derivative-free algorithm for solving this problem. A noise-reduction strategy is employed to handle the presence of noise. Numerical experiments will be presented to illustrate the accuracy and computational efficiency of our method.

3 - Hybrid Representation for the Hydraulic System on the Long-Term Operation Planning of Hydrothermal Systems

Tales Ramos, PhD Student, Federal University of Juiz de Fora, R.: Josè Kneipp Filho, num. 35, Juiz de Fora, 36037230, Brazil, tales.pulinho@engenharia.ufjf.br, Bruno Dias, Ivo Silva Junior, Rafael Brandi, Joao Passos Filho, Andrè Marcato

The main contribution of this work is to present a possibility of a hybrid representation of the hydraulic system. The aim is to allow a representation where some parts of the system are represented by energy equivalent reservoirs and the others are represented individually, considering the majority of the modeling issues, as the nonlinearities on the production function. This model allows a more detailed analysis of the long-term operation planning within a suitable complexity.

4 - Limited-memorgy BFGS with Diagonal Updates

Roummel Marcia, University of California, Merced, 5200 N. Lake Road, Merced, CA, 95340, United States of America, rmarcia@ucmerced.edu

We investigate a formula to solve limited-memory BFGS quasi-Newton Hessian systems with full-rank diagonal updates. Under some conditions, the system can be solved via a recursion that uses only vector inner products. This approach has broad applications in trust region and barrier methods.

■ WD12

12- West 106 A- CC

Applications and Algorithms for Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Yongpei Guan, Associate Professor, University of Florida, Department of Industrial and Systems, Engineering 303 Weil Hall, Gainesville, FL, 32608, United States of America, guan@ise.ufl.edu

1 - Product Portfolio Design with Product Substitutions in an Assemble-to-Order System

Zehra Melis Teksan, University of Florida, ISE Department 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, zmteksan@gmail.com, Joseph Geunes, Chase Rainwater, Semra Agrali

We consider planning decisions for an assemble-to-order system with different customer segments. Each segment has a preferred product as well as acceptable alternative products that result in a substitution cost. Our aim is to determine a product portfolio, substitution plan, and procurement plan in order to maximize profit. We develop a large-scale MILP formulation, show that the problem is NP-Hard, and propose a Lagrangian-relaxation-based algorithm for obtaining near optimal solutions.

2 - Using Quantity Discounts to Improve Coordination in a Two-Level Supply Chain

Jing Ma, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, majing@ufl.edu, Joseph Geunes, Yongpei Guan

We consider a two-level decentralized supply chain where a supplier serves a retailer facing dynamic demands over a finite horizon. We model the problem as a Stackelberg game in which the supplier offers a quantity discount scheme to the retailer, who then orders from the supplier in order to meet fixed demands. The supplier thus determines quantity discount parameters that maximize its profit. We propose algorithms for setting these discount parameters and analyze their impacts on both players.

3 - An Expected Value Constrained Two-stage Stochastic Unit Commitment with Uncertain Wind Power Output

Chaoyue Zhao, 303 Weil Hall, Gainesville FL 32611, United States of America, cherryzhao09@ufl.edu, Yongpei Guan, Qianfan Wang, Jianhui Wang

This paper proposes an expected value and chance constrained stochastic optimization approach to handle the wind power penetration problem for the reliability unit commitment run by ISOs/RTOs. We consider conventional thermal generator constraints while accommodating the wind output uncertainty. We use a Sample Average Approximation (SAA) method to transform the expected objective value, the expected value constraint and the chance constraint into a sample average reformulation.

4 - Lot Sizing with Minimum Order Quantity

Young Woon Park, Northwestern University, Industrial Engineering and Management, Evanston, IL, United States of America, ywpark@u.northwestern.edu, Diego Klabjan

Minimum order quantity is often present in practical lot sizing problems. We study special cases of the general problem from the algorithmic and mathematical programming perspective. We exhibit a polynomial algorithm when capacity is constant and minimum order quantities are ordered. A linear programming extended formulation is provided for the case with constant capacity and minimum order quantity.

■ WD13

13- West 106 B- CC

Integer Programming in Production Settings

Contributed Session

Chair: Deepak Rajan, Lawrence Livermore National Labs, 7000 East Avenue, Livermore, CA, 94550, United States of America, rajan3@llnl.gov

1 - Integrated Production Planning and Preventive Maintenance for a Single Machine

Fahimeh Shamsaei, PhD Student, Université Catholic de Louvain, Rue Constantin Munier, 1/004, Louvain-la-Neuve, 1348, Belgium, fahimeh.shamsaei@uclouvain.be, Mathieu Van Vyve

We consider the integrated problem of preventive maintenance and production planning on a single machine. A set of products must be produced in lots on a capacitated production system throughout a specified finite planning horizon. The capacity decreases over time, unless a preventive maintenance is performed. The objective is to generate an integrated lot sizing and preventive maintenance plan of the system, while satisfying the demand for all products over the entire horizon without backlogging, and which minimizes the expected total production and maintenance costs.

2 - An Integer Programming Approach for Solving the p-Dispersion Problem

Fatemeh Sayyady, North Carolina State University, 2152 Burlington Labs, Raleigh, NC, 27695-7906, United States of America, fsayyad@ncsu.edu, Yahya Fathi

We investigate the relationship between the optimal solution of the p-dispersion problem and that of a corresponding independent set problem. We then use this relationship to devise an exact method as well as an approximation algorithm for solving the p-dispersion problem. We demonstrate the effectiveness of this approach through a comprehensive computation experiment.

3 - The Splittable Flow Arc Set with Capacity and Utilization Constraints

Hande Yaman, Associate Professor, Bilkent University, Department of Industrial Engineering, Bilkent, Ankara, 06800, Turkey, hyaman@bilkent.edu.tr

The splittable flow arc set arises as a relaxation of difficult problems such as the capacitated facility location and network loading, where a capacitated resource is installed in integer quantities. The convex hull of this set is described by its constraints and the residual capacity inequalities. In this talk, we study a closely related set where there are also utilization constraints for the resources. We describe the convex hull in the original space and give an extended formulation.

4 - Tighter Formulations for Unit Commitment Problems

Deepak Rajan, Lawrence Livermore National Labs, 7000 East Avenue, Livermore, CA, 94550, United States of America, rajan3@llnl.gov, Alper Atamturk, Simge Kucukyavuz

In this talk, we present new inequalities that strengthen the polytope of the unit commitment problem. In particular, we focus on ramping constraints (that limit, for each generator, the change in generation levels from one time period to another), and derive new facet-defining inequalities. We conclude by presenting a computational study that illustrates the effectiveness of the new inequalities.

5 - Application of a Mathematical Model for Product Allocation and Warehouse Design

Aman Gupta, Assistant Professor, Embry-Riddle Aeronautical University-WorldWide, 10733 Copper Ridge Dr, Louisville, KY, 40241, United States of America, aman.gupta@erau.edu, Sunderesh Heragu

To perform receiving, storage, picking, and consolidation of SKUs (Stock Keeping Units) in a cost effective manner, a warehouse is divided into several functional areas such as, reserve storage area, forward area and cross-docking. The paper presents an application of a previously published mathematical model for allocation of products to the functional areas in a warehouse and determining the size of these areas using data readily available to a warehouse manager.

■ WD14

14- West 106 C- CC

Metaheuristics for Vehicle Routing Problems

Contributed Session

Chair: Arne L˜kketangen, Professor, Molde University College, Britveien 2, Molde, 6411, Norway, arne.lokketangen@himolde.no

1 - A Real Valued Genetic Algorithm Approach for the Multiple Vehicle Pickup and Delivery Problem

Serap Kiremitci, PhD, Istanbul University, Ulastirma ve Lojistik Yuksekokulu, Avcilar, Istanbul, 34320, Turkey, serapy@istanbul.edu.tr, Timur Keskinturk, Baris Kiremitci

In this paper, we propose a real valued genetic algorithm approach for the solution of Multiple Vehicle Pickup and Delivery Problem with Time Windows (MV_PDPTW). Routes are designed in order to satisfy capacity, time windows, coupling and precedence constraints with the aim of minimization of total costs.Proposed genetic algorithm approach has been tested on available benchmark problem sets and has compared with three previous GA results.

2 - A Granular Variable Neighborhood Tabu Search Algorithm for the Capacitated Location-Routing Problem

John Escobar, University of Bologna, Viale del Risorgimento 2, Bologna, Italy, johnwillmer.escobar2@unibo.it, Maria Gulnara Baldoquin, Paolo Toth, Rodrigo Linfati

We propose a Granular Tabu Search (GTS) with different diversification strategies within a Variable Neighborhood Search (VNS) to solve the Capacitated Location-Routing Problem (CLRP). Computational experiments on benchmark instances show that the proposed approach is able to produce, within short computing times, several solutions obtained by the previously published methods and new best solutions.

3 - A New Two-Phase Hybrid Metaheuristic for the Vehicle Routing Problem with Time Windows

Mingyao Qi, Associate Professor, Graduate School at Shenzhen, Tsinghua University, E204A, Tsinghua Campus, The University Town, Shenzhen, China, qimy@sz.tsinghua.edu.cn, Jinjin Zhang

A new two-phase hybrid metaheuristic is proposed for the vehicle routing problem with time windows. A comparative test is implemented on benchmark problems with sizes varying from 100 to 1000 customers, proposed by Solomon, Gehering and Homberger. Our algorithm has gained 103 new best solutions of 356 problems.

4 - An Ant Colony Algorithm for the Multiple Vehicle Pickup and Delivery Problem with Time Windows

Timur Keskinturk, PhD, Istanbul University, I.U. Faculty of Business Administration, Avcilar, Istanbul, 34320, Turkey, tkturk@istanbul.edu.tr, Baris Kiremitci, Serap Kiremitci

The Multiple Vehicle Pickup and Delivery Problem with Time Windows (MV_PDPTW), which constitutes an important variant of the vehicle routing problems, deals with goods that have to be transported from origin to the destination points. In this paper we propose an ant colony algorithm approach to solve MV_PDPTW. Proposed ant colony algorithm approach has been tested on available benchmark problem.

5 - Large Scale VRP's solved by a Parallel Cooperative Meta-heuristic

Arne Lökketangen, Professor, Molde University College, Britveien 2, Molde, 6411, Norway, arne.lokketangen@himolde.no, Teodor Crainic, Jianyong Jin

We present a parallel cooperative tabu-search based meta-heuristic for solving large scale VRP instances from the literature. Information interchange between the parallel threads are through a central repository. Computational results show that our diversification and intensification approach is highly competitive.

■ WD18

18- West 208 A- CC

Optimization Methodologies: Multiple Objective Problems

Contributed Session

Chair: Victor Carrillo, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, vmcarrillo2@miners.utep.edu

1 - Branch and Cut Algorithm for Multi-objective Integer Optimization Problems

Ozgu Turgut, Graduate Assistant, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, ozgu.turgut@gmail.com, Alper Murat, Evrim Dalkiran

This study requires generating the facets of Pareto surface of multi-objective integer problems at the first step. Then, a branch and cut procedure is applied to generate the whole or some representative portion of the Pareto surface by using the facets obtained in the first step. Computational results will be supplied in order to explore the performance of the algorithm with three objectives.

2 - A New Non-Uniform Weight Generator Method for Post Pareto Analysis

Victor Carrillo, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, vmcarrillo2@miners.utep.edu, Heidi Taboada

In the present research, a new Post-Pareto approach to reduce the non-dominated set of solutions obtained by multiple objective evolutionary algorithms is presented. The proposed method uses a non-uniform weight generator technique to reduce the size of the Pareto-optimal set. Two different examples are presented to demonstrate the applicability of the developed non-uniform weight generator method.

■ WD19

19- West 211 A- CC

Decision Analytic and Patient-Centered Modeling in Medicine

Cluster: INFORMS/SMDM Applications Joint Cluster

Invited Session

Chair: Jagpreet Chhatwal, Assistant Professor, University of Pittsburgh, 130 De Soto St, Pittsburgh, PA, United States of America, chhatwal@pitt.edu

Co-Chair: Jeremy Goldhaber-Fiebert, Assistant Professor of Medicine, Stanford University School of Medicine, 117 Encina Commons, Room 217, Stanford, CA, 94305-6019, United States of America, jeremygf@stanford.edu

1 - Optimizing the Care of Children with Acute Liver Failure: The Decision to List for Transplantation

Mark Roberts, Professor, University of Pittsburgh, 130 De Soto Street, A620 Crabtree Hall, Pittsburgh, PA, 15261, United States of America, mroberts@pitt.edu

Pediatric acute liver failure (PALF) is a complex, devastating, often rapidly fatal disease for which liver transplantation is a potentially lifesaving treatment. However, many children with PALF will recover: these patients are not benefited by transplantation. Therefore, the decision to list a child for transplantation represents a complex optimal timing question. We present the development and early results of a physiologically based individual microsimulation model of PALF that can be used to evaluate different transplantation decisions.

2 - Modeling Obesity from the Population Perspective

Y. Claire Wang, Assistant Professor, Columbia University, 600 W 168th St 6th Fl, New York, NY, 10032, United States of America, ycw2102@columbia.edu

Obesity is a major contributor to the health care cost challenges we confront today in the United States and abroad. Currently, one in three U.S. adults and 17% of children and teens are obese. There are also significant race-ethnic and income disparities. I will provide an overview on the current and emerging research opportunities to apply systems science and simulation methods to understand causes and consequences and to evaluate strategies and solutions.

3 - The Cost-effectiveness of Supervised Consumption Facilities in Toronto, Canada

Ahmed Bayoumi, Associate Professor, University of Toronto, St. Michael's Hospital, 30 Bond St., Toronto, ON, M5B 1W8, Canada, ahmed.bayoumi@utoronto.ca, Jennifer Jairam, Carol Strike, Greg Zaric, Eva Enns

We evaluated the cost effectiveness of establishing sanctioned facilities where people inject drugs under supervision in Toronto using a dynamic compartmental model accounting for the spread of HIV and Hepatitis C. One facility would cost $31,781/QALY compared to none; 2 facilities would cost $36,993/QALY. At thresholds of $50 and $100,000/QALY, it would be cost-effective to establish 3 and 4 facilities, respectively. Results were sensitive to assumptions population size, costs and efficacy.

4 - Heterogeneity in Women's Adherence and its Role on Optimal Breast Cancer Screening Policies

Turgay Ayer, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, ayer@isye.gatech.edu

The existing controversial breast cancer screening policies consider only women's age but ignore several other personal breast cancer risk factors and women's adherence to screening recommendations. In this study, we propose a model to redesign the controversial breast cancer screening policies by tailoring the screening decisions to women's personal risk and adherence levels.

■ WD20

20- West 211 B- CC

Healthcare Operations Management

Cluster: INFORMS/SMDM Applications Joint Cluster

Invited Session

Chair: Pinar Keskinocak, Professor, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332, United States of America, pinar@isye.gatech.edu

Co-Chair: Joel Tsevat, University of Cincinnati, Cincinnati, OH, United States of America, joel.tsevat@uc.edu

1 - Working Together, Getting Things Done – Encouraging Collaboration Between the OR and Healthcare Communities

James Stahl, Massachusetts General Hospital, Boston, MA, United States of America, jstahl@mgh-ita.org

The purpose of this session is discuss how to encourage the development of ideas and collaborations between the OR and healthcare communities and how to actually get them adopted. Experienced practitioners will share insights from their experiences designing and implementing systems ranging from the micro (e.g., redesigning operating rooms) to the macro (e.g., healthcare policy).

2 - Adaptive and Anticipative Decisions in Operating Room Rescheduling

Sakine Batun, Assistant Professor, Middle East Technical University, Ankara, Turkey, sakine@ie.metu.edu.tr, Andrew Schaefer, Brian Denton

We consider a stochastic multi-OR scheduling problem where the initial schedule is revised at a prespecified time during the surgical day. We formulate the problem as a SMIP that minimizes the sum of the fixed cost of opening ORs and the expected overtime cost. For our numerical study, we consider a special case where rescheduling decisions are made under perfect information. We use our model to estimate the value of adaptive and anticipative decisions in OR rescheduling.

3 - Strategic Resource Planning for a Population with Mental Health and Addiction Issues

Martin Puterman, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Martin.Puterman@sauder.ubc.ca, Greg Werker, Michael Krausz

The number of people living with complex concurrent disorders – including mental health and addiction issues – in Vancouver's Downtown Eastside is staggering. Myriad organizations provide healthcare and other services, yet no high-level quantitative strategic approach exists to model the entire system. We use queueing theory to study how clients flow through services. Our model can inform procedural and policy changes in order to better allocate resources to existing and new programs.

■ WD21

21- West 212 A- CC

Network Applications II

Sponsor: Optimization/Networks

Sponsored Session

Chair: Mehmet Ertem, Graduate Student, University of Wisconsin-Madison, 1513 University Avenue, 3237 Mechanical Engineering Building, Madison, WI, 53706, United States of America, ertem@wisc.edu

1 - An Integer Programming Approach to Determine Maximum Ambiguity in Fault Tolerant Sensor Networks

Sibel B. Sonuc, PhD Candidate, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, sibel.bilge@ufl.edu, J. Cole Smith

We study fault tolerant sensor networks where among a set of sensors deployed, a subset of them might fail. A faulty sensor may or may not report a false reading. As a result, the network owner may not be able to clarify the status of every node. A node is called an ambiguous node, if it is not possible to clarify the status of that node with the current sensor reports. We propose an integer programming approach for finding the maximum number of ambiguous nodes subject to the sensor reports.

2 - Routing Vehicles in a Wafer Manufacturing Facility

Kelly Bartlett, PhD Student, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States of America, kelly.bartlett@gatech.edu, Junho Lee, Shabbir Ahmed, George Nemhauser, Byungsoo Na, Joel Sokol

In a semiconductor manufacturing facility, rail-based vehicles transport wafers from machine to machine. Because processing times are variable, the associated routing problem is an online optimization problem in a congested network. We develop algorithms for vehicle selection and routing in order to minimize mean travel times and their variability and also to minimize travel time prediction errors. We provide results from a simulated prototype facility.

3 - A Stochastic Network-interdiction Model for Cyber Security

Mehmet Ertem, Graduate Student, University of Wisconsin-Madison, 1513 University Avenue, 3237 Mechanical Engineering Building, Madison, WI, 53706, United States of America, ertem@wisc.edu, Vicki Bier

We propose a general defender-attacker model for security of computer networks, using attack graphs to represent possible attacker and defender options. The defender's objective is to maximize the security of the network under a limited budget. The attacker's success or failure on any arc of the attack graph is probabilistic. To represent the ability of the attacker to launch multiple attempts, we formulate the resulting problem as a multiple-stage stochastic network-interdiction problem.

4 - Incremental Network Design with Maximum Flow

Dmytro Matsypura, Lecturer, University of Sydney, Rm 478, Merewether Building, Sydney, Australia, dmytro.matsypura@sydney.edu.au, Martin Savelsbergh, Thomas Kalinowski

Network infrastructure upgrades are a common phenomenon and typically occur over time due to various constraints. We consider a class of incremental network design problems and focus on one of its variants: incremental network design with maximum flow. We present an integer program formulation, investigate structural properties of optimal solutions and analyze worst-case performance of various heuristics.

■ WD22

22- West 212 B- CC

Stochastic Optimization for Resource Allocation

Sponsor: Computing Society

Sponsored Session

Chair: Nedialko Dimitrov, Assistant Professor, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, ned@nps.edu

1 - Increasing Network Reliability by Introducing Warehouses

Christian Klaus, PhD Student, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, cklaus@nps.edu, Nedialko Dimitrov

Humanitarian assistance is often shipped using available space on regularly scheduled transportation routes. We model the selection of warehouse locations to increase shipment reliability as a two-stage stochastic program where we first install warehouses, then the transportation routes are revealed and the shipment is executed if possible. Computing the network's reliability given warehouse locations is #P hard. We discuss some computational methods for finding good warehouse locations.

2 - Budget Allocation Policies for School Districts: A Robust MDP Approach

Stanko Dimitrov, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, sdimitro@uwaterloo.ca, Nedialko Dimitrov, Stefanka Chukova

We present a robust Markov Decision Process (MDP) approach for allocating funding to schools in a school district over a finite planning horizon. We propose a new analytic method, derived from control theory, for solving robust MDPs with coupling budget constraints. The new approach takes into account past school performance and a limited school district budget. We conclude by providing an application of the new method to a school funding allocation problem.

3 - Finding the Needles in the Haystack: Efficient Intelligence Collection

Nedialko Dimitrov, Assistant Professor, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, ned@nps.edu, Moshe Kress

For intelligence agencies, typically, much more data is available than what can be screened in the allotted time. We formulate the problem faced by an intelligence screener as an exploration-exploitation problem: the screener has to choose between exploring for new sources of information and exploiting known sources. We develop a mathematical model of the collector's knowledge and examine algorithms that allow the collector to maximize the discovery of relevant data given a time limit.

■ WD24

24- West 213 A- CC

Optimization and Machine Learning Methods for Brain Data Analysis

Cluster: Health Informatics

Invited Session

Chair: W. Art Chaovalitwongse, Associate Professor, University of Washington, 3900 Stevens Way, Seattle, WA, 98195, United States of America, artchao@uw.edu

1 - Quantitative EEG Analysis in Epilepsy Research

Petros Xanthopoulos, University of Central Florida, Department of Industrial Engineering, Orlando, FL, United States of America, petrosx@ucf.edu

In this presentation we will discuss some of the key applications of signal processing and machine learning in quantitative electroencephalographic (EEG) analysis. Topics to be discussed include brain EEG connectivity, non linear timeseries analysis and applications of wavelets in scoring and predicting and discriminating between different EEG states.

2 - A New Statistical Learning Method for Mouse Brain Segmentation

Min Zhang, Arizona State University, 699 S Mill Ave., Tempe, AZ, 85281, United States of America, mzhang33@asu.edu, Teresa Wu, Alexandra Badea, Rong Pan

We introduce a new statistical learning method, integrating Support Vector Machine (SVM) and Markov Random Field (MRF) approaches, to segment different transgenic mouse brain models Magnetic Resonance Microscopy (MRM) images. By using our model, more accurate, computational efficient and robust result can be achieved.

3 - Network Modeling Framework to Predict Cognitive Decline

W. Art Chaovalitwongse, Associate Professor, University of Washington, 3900 Stevens Way, Seattle, WA, 98195, United States of America, artchao@uw.edu, Sherry Willis, Paul Borghesani, Georgiy Presnyakov, Tom Grabowski

Intrinsic connectivity networks, including the default mode network (DMN), can be identified via resting state functional connectivity MRI (fcMRI) and help illuminate large-scale connectivity underlying cognition and behavior. We investigated local, intra-nodal connectivity within nodes of the DMN using graph theory methods. We hypothesized that local connectivity of individual DMN nodes would differ with midlife cognitive trajectory, specifically with changes in executive function.

■ WD25

25- West 213 B- CC

Healthcare Applications of Operations Research

Sponsor: Health Applications Society

Sponsored Session

Chair: Anahita Khojandi, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States of America, ank83@pitt.edu

1 - Dynamically Optimizing the Administration of Vaccines from Multi-dose Vials

Maryam Hasanzadeh Mofrad, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, mah249@pitt.edu, Lisa Maillart, Bryan A. Norman, Jayant Rajgopal

We examine the question of when to open multi-dose vials of vaccines given that partially used vials have a limited shelf life. Under the objective of maximizing the expected number of vaccinations administered between consecutive stock replenishments, we formulate and a Markov decision process model that determines when to cease vaccine administration as a function of time of day, vial inventory and the number of days until replenishment. Structural and numerical results are presented.

2 - A Branch-and-cut Algorithm to Solve a Kidney Exchange Model

Amin Dehghanian, PhD Student, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States of America, AMD120@pitt.edu, Murat Kurt, Andrew Schaefer

We propose a decomposition based branch-and-cut algorithm to solve a large scale two-stage stochastic mixed binary linear program available in the literature for a kidney exchange problem. We are using the idea of minimal infeasible subsystem cut generation in the literature. In addition, we present two classes of combinatorial valid inequalities. We also dynamically update notorious big-M coefficients and binary variables as the branch-and-cut algorithm proceeds.

3 - A POMDP Approach for Imputing Rewards to Time-dependent Breast Cancer Screening Policies

Kuang-Hao Buch, North Carolina State University, 400 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27695, United States of America, kyeh@ncsu.edu, James Wilson, Julie S. Ivy

This research seeks to improve the understanding of the costs of a recommended breast cancer screening policy. When evaluating screening policies, the involved costs are difficult to quantify and justify.This study develops an inverse algorithm applied to a POMDP-based model for breast cancer screening policies. Our study identifies the implied costs, measured in mortality rates. This study explores the relationship among the implied mortality rates associated with different screening policies.

4 - Optimal Implantable Cardioverter Defibrillator (ICD) Generator Replacement

Anahita Khojandi, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States of America, ank83@pitt.edu, Oleg Prokopyev, Lisa Maillart

There is a trade-off between prematurely exposing ICD patients to the risk of generator replacement surgeries and allowing for the possibility that the devices are unable to deliver therapy when needed. We develop a Markov decision process model to maximize the total expected lifetime of the patient. We analytically establish that the optimal policy is of threshold-type in the ICD battery capacity. Based on clinical data and the literature, we conduct a large scale numerical experiment.

■ WD27

27- North 221 B- CC

Strategic Supply and Strategic Consumers

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Gustavo Vulcano, Associate Professor, New York University, 44 West Fourth St., Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu

1 - Optimal Continuous Pricing with Strategic Consumers

Luis Briceno, Universidad de Chile, Santiago, Chile, lbriceno@dim.uchile.cl, Jose Correa

An important problem in electronic commerce is that of ending an optimal mechanism to sell a single item when the number of bidders is random. In this paper we take a step further and derive an optimal pricing scheme when consumers arrive over time according to a random process. Combining auction theory and recent work on pricing with strategic consumers, we derive the optimal pricing mechanism in this situation under mild conditions.

2 - Dynamic Pricing of Experience Goods of Unknown Quality: The Impact of Consumer Reviews

Roman Kapuscinski, Professor, Ross School of Business, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, kapuscin@umich.edu, Man Yu, Laurens Debo

We consider pricing of goods whose quality is unknown to the firm, but, is imperfectly assessed by consumers that purchased the good and who transmit their assessment via consumer reviews to consumers that did not buy yet the good.

3 - Optimizing the Timing of New Product Introductions in the Presence of Strategic Customers

Jigar Patel, NYU-Stern, 44 West 4th Street, KMC 8-152, New York, NY, 10012, United States of America, jigar@stern.nyu.edu, Ilan Lobel, Jiawei Zhang, Gustavo Vulcano

We consider the problem of a technology firm deciding the optimal timing of its product introductions. Consumers are strategic and weigh the value of purchasing improved products in light of future technological improvements. We show that the optimal policy consists of alternating cycles, with long introduction intervals following short ones. We also show how to implement such policies when the firm does not have the power to commit to future launch dates.

■ WD28

28- North 221 C- CC

Supply Chain and Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Robert Swinney, Associate Professor, Graduate School of Business, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, swinney@stanford.edu

1 - Supply Chain Contracting with Limited Demand Information

Houyuan Jiang, University Senior Lecturer, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, h.jiang@jbs.cam.ac.uk, Serguei Netessine

The well-known buy-back contract in supply chains is investigated when only limited demand information is available to both retailer and supplier. When the demand support is the only available information, we show that the buy-back contract can never coordinate the supply chain except for the degenerate solutions under certain conditions. We explore demand information requirements as well as contract enhancements for coordinating supply chains.

2 - Collaborative Forecast between Retailers under Endogenous Wholesale Price

Hyo duk Shin, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, hyoduk-shin@kellogg.northwestern.edu, Noam Shamir

We study the incentives of newsvendor retailers to share demand information when the wholesale price is set endogenously. We show how the timing of the manufacturer's pricing decision affects the motivation of the retailers to share information, and that the manufacturer can be worse-off or better-off when information is shared.

3 - Strategic Analysis of Dual Channel Supply Chains with Digital Goods

Yinliang (Ricky) Tan, University of Florida, P.O. Box 117169, Gainesville, FL, 32611-7169, United States of America, tanyinliang@ufl.edu, Janice Carrillo

The advent of digital goods has made a significant impact on traditional markets for items such as videos and books. We study decision strategies facing retailers and publishers by formulating a dual channel model which includes distribution of both traditional and digital goods. Our results identify circumstances under which it is optimal for the retailer to sell only digital goods in the marketplace.

4 - Econometric Analysis of Effect of Re-admission Rates on Marginal Costs in Hospital Services

Aleda Roth, Professor, Clemson University, Department of Management, 100 Sirrine Hall, Clemson, SC, 29634, United States of America, aroth@clemson.edu, Lawrence Fredendall, Sriram Venkatraman

We investigate the effect of re-admission rates on marginal cost incurred by a hospital. We use secondary data derived from multiple sources, including Center for Medicare and Medicaid Services. We apply an inversion method and demand-supply-side estimation procedures developed in the empirical Industrial Organization literature to estimate marginal cost of a hospital.

■ WD29

29- North 222 A- CC

Challenges and Strategic Decisions in Healthcare Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations/SIG

Sponsored Session

Chair: Hui Zhao, Assistant Professor, Krannert School of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47906, United States of America, zhaoh@purdue.edu

1 - The Role of Milestone-Based Contracts for Coordinating R&D Partnerships

Sameer Hasija, INSEAD, Fontainbleau, France, sameer.hasija@insead.edu, Shantanu Bhattacharya, Vibha Gaba

We analyze optimal contractual arrangements in a bilateral R&D partnership between a risk-averse provider that conducts early-stage research, followed by a regulatory verication stage, and a risk neutral client that performs late-stage development activities, including production, distribution, and marketing. The problem is formulated as a sequential investment game with the client as the principal, where the investments are observable but not veriable.

2 - Pharmaceutical Capacity Planning: Partial Outsourcing and Heterogeneous Capacities

Hiroko Okajima, PhD. Candidate, Smeal College of Business, Penn State University, 467 Business Building, University Park, PA, 16802, United States of America, huo104@psu.edu, Hui Zhao, Susan Xu

Motivated by industry examples, we study drugmaker's partial outsourcing/capacity expansion strategies during a drug's patent protected period. The firm can build in-house capacity and also avail of outsourcing via an option contract. The optimal policy is characterized by 2 base-capacity levels in a 3-period problem. A general problem is discussed in a numerical study. Partial outsourcing is indeed optimal in most cases and is critical right after product launch and near patent expiration.

3 - Brand Drug Distribution: Fee-for-Service vs. Direct-to-Pharmacy

Yao Zhao, Associate Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, yaozhao@andromeda.rutgers.edu, Katie Lacocca, Adam Fein

The U.S. pharmaceutical supply chain is under drastical transformation from asset-based Fee-for-Service agreement to Direct-to-Pharmacy agreement that transfers the ownership of channel inventory to the manufacturer. Such a transition generated a heavy debate among industry observers. Using mathematic models and real world examples, we compare these agreements for the pharmaceutical supply chain as a whole and its individual participants.

4 - Impact of Payer-Provider Integration on Quality, Access, Cost, and Social Welfare

Aaron Ratcliffe, University of North Carolina at Chapel Hill, CB 3490, Chapel Hill NC 27599, United States of America, Aaron_Ratcliffe@kenan-flagler.unc.edu, Ann Marucheck, Wendell Gilland

We develop a queuing game to analyze interaction of a profit-maximizing health provider which chooses quality and capacity and cost-minimizing insurer which sets its coinsurance rate. We compare quality, access, cost and social welfare between a competitive managed care model and integrated model where the provider insures its patient population.

■ WD30

30- North 222 B- CC

Applications of Facility Location

Contributed Session

Chair: Ashwin Arulselvan, TU Berlin, Strasse Des 17 Juni, Berlin, Germany, arulsel@math.tu-berlin.de

1 - A Gradient Model of Economy Effects for High Speed Railway

Li Zhang, IBM Research-China, Building 19, 8 Dongbeiwang West Road, Beijing, China, zhanglir@cn.ibm.com, Dingding Lin, Yongqing Xue

As a government decision, the allocation of High Speed Rail stations has significant and permanent effects of local economy. This paper intents to evaluate the effects on HSR network in China i.e., the changing relationship of annual investment and GDP growth. Based on diffusion equation, a simple regional interacted model is constructed to reflect economy dispersion and combination. With historical data of 5 cities, numerical analysis is carried out and influence levels are shown.

2 - P-hup Formulation with Linearization of Logit Model for the Park-and-Ride Facility Location Problem

Felipe Aros-Vera, PhD Candidate, Rensselaer Polytechnic Institute, 256 25th St, Troy, NY, 12180, United States of America, arosvm@rpi.edu, Vladimir Marianov

We optimally locate Park and Ride (P&R) facilities, modeled as capacitated hubs. P&R usage is maximized. Commuters can either use the service or choose to travel by car, and their behavior follows a logit model. We consider users' generalized cost of P&R facilities as input for the logit. We propose a novel linearization of the demand model. A modification of Heuristic Concentration Integer procedure is applied to solve larger instances. Numerical results and a case in Queens, NY, are shown.

3 - A Branch-and-Cut Algorithm for Incremental Connected Facility Location Problem

Ashwin Arulselvan, TU Berlin, Strasse Des 17 Juni, Berlin, Germany, arulsel@math.tu-berlin.de, Ivana Ljubic, Andreas Bley

We are given an instance of facility location problem with a planning horizon. We are required to incrementally serve the customers over the planning period in order to maximize the net present value. We provide an integer program and present valid inequalities to strengthen the model. We study exact and heuristics procedures for the separation routine. We briefly discuss a lifting procedure to strengthen these inequalities. We conclude with computational results of our implementation.

■ WD31

31- North 222 C- CC

Customer Heterogeneity, Crowding, and Queueing Effects in Services

Sponsor: Manufacturing & Service Oper Mgmt/Service Operations

Sponsored Session

Chair: Serhan Ziya, University of North Carolina, 356 Hanes Hall CB# 3260, Chapel Hill, NC, 27599, United States of America, ziya@unc.edu

1 - The Impact of Customer Heterogeneity on Service Satisfaction

Ryan Buell, Assistant Professor, Harvard Business School, Morgan Hall T37, Boston, MA, 02163, United States of America, rbuell@hbs.edu, Dennis Campbell, Frances Frei

We decompose the variance of 58,294 face-to-face retail banking transactions, quantifying the relative importance of customer, employee, process, location and market-level effects on satisfaction outcomes. We find that customer-level differences account for most of the explained aggregate variance, demonstrate that customer compatibility with the operating model is a primary determinant of service outcomes, and show that firms facing greater heterogeneity have less satisfied customers.

2 - Joining (and leaving) Observable and Unobservable Queues – An Experimental Investigation

Mirko Kremer, Pennsylvania State University, State College, PA, United States of America, muk22@smeal.psu.edu, Laurens Debo

We present results from a set of laboratory experiments designed to test some of the key predictions of queuing theory. Specifically, we study how customers form expectations about queue lengths and waiting times when they arrive at a service facility, and their subsequent queue joining decisions.

3 - Price Signaling in a Congested Environment

Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu, Senthil Veeraraghavan, Uday Rajan

Often, high-quality firms have long queues. A question is why these firms do not raise prices? In this talk, I will discuss the superior informational role that queues can play in conveying information about quality to uninformed consumes.

4 - Managing the Customer Mix and Crowding for Shared Services via Pricing and Capacity Allocation

Dimitris Kostamis, University of North Carolina-Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, dimitris_kostamis@unc.edu, Serhan Ziya

We study a system serving two classes; within each class, customers are heterogeneous in their inherent willingness to pay for service, but their utilities are also affected by the type and number of other customers. Under price discrimination, an exclusive system can be optimal and that depends only on classes' perceptions about each other. Under a single price, an exclusive system is even more likely. We also show when and how the provider should allocate capacity to prevent class interaction.

■ WD32

32- North 223- CC

Supply Chain Procurement and Sourcing

Sponsor: Manufacturing & Service Oper Mgmt/Supply Chain

Sponsored Session

Chair: Tharanga Rajapakshe, Assistant Professor, University of Florida, Warrington School of Business Administration, Gainesville, FL, 32606, United States of America, Tharanga.rajapakshe@warrington.ufl.edu

Co-Chair: Mili Mehrotra, University of Minnesota, 321 19th Ave., South, Minneapolis, MN, United States of America, milim@umn.edu

1 - Using Procurement Service Providers (PSP) in Supplier Selection

Sripad Devalkar, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sripad_devalkar@isb.edu, Zhixi Wan

In this research, we address the question of a how a buyer can make the best use of procurement service providers (PSP) in the supplier selection process. Specifically, we consider how the buyer should set the service requirement (number of pre-qualified suppliers recommended), and provide incentives to motivate the PSP to better screen the recommended suppliers. We characterize the optimal decisions for the buyer under different conditions of supplier quality and cost heterogeneity.

2 - Analysis of Tailored Base-Surge Policies in Dual Sourcing Inventory Systems

Ganesh Janakiraman, Associate Professor, Jindal School of Management, The University of Texas at Dallas, Richardson, TX, 75080, United States of America, ganesh@utdallas.edu, Sridhar Seshari, Anshul Sheopuri

We study a firm managing its inventory by sourcing supplies from two supply sources, a low cost, slow regular supplier and a high-cost, emergency, supplier. Firms often use a Tailored Base-Surge(TBS) Policy (Allon and Van Mieghem 2010) in such cases: Procure a constant quantity from the regular supplier in every period and choose the emergency procurement quantity dynamically. We present a set of analytical results to understand when these policies are most effective.

3 - Optimal Procurement Auction with Sequential Supplier Qualification

Wei Chen, PhD Student, Jindal School of Management, The University of Texas at Dallas, 800 W. Campbell Road, Richardson, TX, 75080, United States of America, wei.chen@utdallas.edu, Ganesh Janakiraman, Milind Dawande

A firm is soliciting price bids for a sourcing contract from N suppliers. The contract can only be awarded to a supplier who passes two rounds of qualification/testing, which can be performed sequentially or simultaneously. We study a two period optimal mechanism design problem in which some suppliers take the first test in the first period and some among the successful take the second test in the second period, and some of the untested suppliers take the integrated test in the second period.

4 - Product Differentiation through Environmental Quality

Tim Kraft, University of Virginia, Darden School of Business, Charlottesville, VA, 22902, United States of America, kraftt@darden.virginia.edu, Ozgen Karaer, John Khawam

We examine a firm's investments in environmental quality when prices are fixed but a shift in market segmentation has occurred. Our research goals are to 1) better understand how a firm can differentiate its product through quality investments and 2) identify how a firm should work with a supplier to improve the environmental quality of the firm's product.

■ WD33

33- North 224 A- CC

Brand and Competition

Contributed Session

Chair: Ming Zhao, PhD candidate, Hong Kong Polytechnic University, Hung Hom, Hong Kong, Hong Kong, China, 10900716r@connect.polyu.hk

1 - Dynamic Brand Satiation
Nobuhiko Terui, Professor, Tohoku University, Kawauchi, Aoba-ku, Sendai, 980-8576, Japan, terui@econ.tohoku.ac.jp, Shohei Hasegawa, Greg Allenby

A dynamic factor model of brand satiation is developed to explain longitudinal variation in consumer purchases. Factor loadings are associated with a brand's position along a satiation dimension, and factor scores are associated with a household's sensitivity to satiation effects. Empirical analysis of a panel dataset of corn chips purchases indicates the implications for product line assortment in the face of quickening satiation.

2 - The Impact of Competition on Pricing in a Two-sided Market
Minkyung Kim, Seoul National University Business School, 1 Gwanak-ro, Gwanak-gu, Seoul, 151-916, Korea, Republic of, aude87@snu.ac.kr, Inseong Song

This paper develops an empirical model to investigate the impact of competition on optimal pricing of a durable product under indirect network effect. The model accounts for consumers' forward-looking behaviors in the demand side and for competitive dynamics in the supply side. We apply our model to the video game console market, a canonical example of two-sided market. We compare the competitive equilibrium prices with the counterfactual prices assuming no competition.

3 - Store Brand Competition and Strategic Quality Decisions
Ryan Choi, University of California, Irvine, 335 SB, UCI, Irvine, CA, 92617, United States of America, jihungc@uci.edu

This paper addresses the questions how retailers design store brand products under different market characteristics such as the intensity of competition, consumers' heterogeneity, and the manufacturer's strategic decisions. Interestingly, we find that symmetric retailers have an incentive to decrease the product quality of their store brands as the competition among them gets more intense, while a monopolistic retailer positions its store brand product relatively close to the national brand.

4 - Free In-Network Pricing as an Entry-Deterrence Strategy
Tingting He, Assistant Professor of Marketing, University of Wisconsin-Milwaukee, 3202 N Maryland Ave., Milwaukee, WI, 53211, United States of America, he2@uwm.edu, Dmitri Kuksov, Chakravarthi Narasimhan

This paper studies the three common types of payment plans in telecommunications industry: metered, free in-network and flat-fee calling plans. We examine profit implications of these three types of plans in competitive settings, and find that free in-network calling plan has entry-deterrence power.

5 - Daily Deal Sites Like Groupon and LivingSocial: Signaling Effects and Consumers' Perceptions
Ming Zhao, PHD Candidate, Hong Kong Polytechnic University, Hung Hom, Hong Kong, Hong Kong, China, 10900716r@connect.polyu.hk, Xianghua Gan

Daily deal sites have been growing at an impressive rate. On a daily deal site, merchants offer large discounts that would appeal to locals; the daily deal site sells discount vouchers to its subscribers and takes a portion of the revenue. We show that if a merchant offers a deep discount in a daily deal promotion and if the regular price is observable, then rational and informed consumers will perceive the product to be of high quality, and respond positively to the promotion.

■ WD34

34- North 224 B- CC

Remanufacturing

Contributed Session

Chair: Charles Wang, Associate Professor, SUNY at Buffalo, 326 M Jacobs Management Center, Buffalo, NY, 14260, United States of America, cxwang@buffalo.edu

1 - Remanufacturing Scheduling: Academic Research and Industry Practice
Roger Gagnon, Associate Professor, North Carolina A&T State University, Department of Management, School of Business and Economics, Greensboro, NC, 27411, United States of America, gagnonr@ncat.edu, Shona Morgan

To compare the academic progress achieved in remanufacturing scheduling to those practices followed in industry. Comparisons are made in determining market demands, production lot sizes and sequences, buffer inventory policies, disassembly release mechanisms, production planning, priority scheduling rules, and disposal policies. Suggestions for future research needs are offered.

2 - Optimum Target Quality in Sustainable Manufacturing
Farhad Azadivar, Professor, University of Massachusetts Dartmouth, 40 William Street, South Dartmouth, MA, 02748, United States of America, fazadivar@umassd.edu, Neda Masoud

An analytical solution is presented for the optimum quality to target when returned products are recycled. Any product delivered to customer is replaced if returned for any reason. Returned products are disassembled, 100% inspected and their good parts are used in remanufactured after market products. The paper explores the tradeoff between the costs of the targeted quality versus the additional cost of remanufacturing using returned parts.

3 - Closed-loop Supply Chain Models in Manufacturing-Remanufacturing Operations
Tianqin Shi, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 South Sixth Stree, Champaign, IL, 61801, United States of America, tshi3@illinois.edu, Dilip Chhajed

Consider a supply chain with two divisions of a firm and a retailer. One division is responsible for designing and manufacturing the product while the other division is responsible for remanufacturing operation. We explore the impact of decentralization on product design, pricing, and profits. We also examine incentive mechanisms to facilitate coordination between the two profit maximizing divisions to improve the economic and environmental performance of the supply chain.

4 - OEM Cooperation in the Returns Channel
Serra Caner Bulmus, MSc, University of Groningen, Nettelbosje 2, Groningen, 9747 AE, Netherlands, s.caner@rug.nl, Stuart Zhu, Ruud Teunter

We consider cooperation between original equipment manufacturers (OEMs) to increase the efficiency of the reverse channel performance, using cooperative game theory. We analyze when it is beneficial for OEMs to form grand coalition and determine stable gain allocation schemes. Important insights are that cooperation is beneficial if OEMs have comparable revenues / savings per returned item, but not necessarily similar market shares. Also, cooperation is more likely for higher economies of scale.

5 - Closed-loop Supply Chain Design for a High-Tech Product
Charles Wang, Associate Professor, SUNY at Buffalo, 326 M Jacobs Management Center, Buffalo, NY, 14260, United States of America, cxwang@buffalo.edu, Chia-Hung Chuang

We study a closed-loop supply chain for a short life-cycle high-tech product. We consider the manufacturer's choice of three alternative reverse channel structures: manufacturing collecting, retailer collecting, and third-party collecting. We compare the manufacturer's performance under the three reverse channel structures when there are economies or dis-economies of scale in collection cost.

■ WD35

35- North 225 A- CC

Revenue Management in Online Advertising

Sponsor: Revenue Management & Pricing

Sponsored Session

Chair: Hamid Nazerzadeh, Marshall School of Business, University of Southern California, Los Angeles, CA, United States of America, hamidnz@marshall.usc.edu

1 - Simultaneous Approximations for Adversarial and Stochastic Online Budgeted Allocation
Shayan Oveis Gharan, Stanford University, 475 Via Ortega, Huang Engineering Center 314K, Stanford, CA, 94305, United States of America, shayan@stanford.edu, Vahab Mirrokni, Morteza Zadimoghaddam

In the online budgeted allocation problem we are given a set of advertisers with their daily budgets. When a query arrives, its incident edges, and their respective weights, are revealed, and the algorithm must match to an advertiser, irrevocably. The objective is to maximize the total revenue, while respecting the daily budgets. In this paper we design algorithms that achieving a nearly optimal 1-1/e worst case competitive ratio, while obtaining significantly better than 1-1/e on the average.

2 - Optimal Mechanisms for Selling Information
Renato Paes Leme, Cornell University, 4139 Upson Hall, Ithaca, NY, 14853, United States of America, renatoppl@cs.cornell.edu, Robert Kleinberg, Moshe Babaioff

In this paper we study the design of optimal mechanisms for a monopolistic data provider to sell information to a buyer, in a model where both parties have (possibly correlated) private signals about a state of the world, and the buyer uses information learned from the seller, along with his own signal, to choose an action (e.g., displaying an ad) whose payoff depends on the state of the world.

3 - A Clustering Approach to Bid Optimization on Behalf of Advertisers
MohammadHossein Bateni, Research Scientist, Google Inc., 76 Ninth Ave., New York, NY, 10011, United States of America, bateni@gmail.com

We study the problem of maximizing the number of clicks subject to budget constraints for advertisers. Given bid landscapes that are typically provided by some ad-serving systems, we formulate the problem and optimize the profit given budget constraints. We consider bidding strategies that consist of no more than k different bids for all the keywords. We present a PTAS when k is constant and constant-factor approximation otherwise.

■ WD37

37- North 226 A- CC

Revenue Management: Yield Management

Contributed Session

Chair: Yueshan Yu, Washington University in St. Louis/Olin Business School, One Brookings Drive, Campus Box 1133, Saint Louis, MO, 63117-1518, United States of America, yuyu@wustl.edu

1 - Classifying Revenue Management Practices: A Typology to Assess and Improve Business Practice
Frederick Ng, PhD Student, University of Auckland, Department of Accounting & Finance, 12 Grafton Road, Auckland, New Zealand, f.ng@auckland.ac.nz, Paul Rouse, Julie Harrison

Revenue management's (RM) focus on a variety of techniques and industries suggests a need for a common framework to classify differences in practice. From practitioner interviews we identify seven indicators and construct a decision tree to holistically rank RM across diverse business settings. We apply the system in a survey of 231 businesses. Results examine theories about where RM is used, opportunities to apply RM in new settings, and areas to develop beginner and intermediate RM techniques.

2 - Revenue Management Competition
Petr Fiala, Professor, University of Economics Prague, W. Churchill Sq. 4, Prague, 13067, Czech Republic, pfiala@vse.cz

Revenue management is the process of understanding, anticipating and influencing customer behavior in order to maximize revenue. Many important components such as pricing, capacity management, and overbooking have been extensively studied, competition have not received enough attention. The models are readily extended to competitive settings. The paper is devoted to modeling of competition in revenue management. The revenue management problems under competition can be formulated as games.

3 - Dynamic Capacity Management with General Substitution
Yueshan Yu, Washington University in St. Louis/Olin Business School, One Brookings Drive, Campus Box 1133, Saint Louis, MO, 63117-1518, United States of America, yuyu@wustl.edu, Fuqiang Zhang, Xin Chen

This paper studies a multiclass, multiperiod capacity allocation problem with general substitution. We characterize the optimal allocation policy that has a simple two step structure and can be solved sequentially. Although it is computationally intensive to solve the optimal policy, we provide an efficient heuristic that perform well under a wide range of practical situations.

4 - Durable Goods Pricing in the Presence of Volatile Demand
Xiaobo Zheng, University of Rochester, Rochester, NY, 14627, United States of America, xiaobo.zheng@simon.rochester.edu, Vera Tilson

We constructed an infinite-horizon game between a monopolistic durable goods manufacturer and heterogeneous consumers to investigate the impact of demand volatility on the production and pricing decisions. We modeled the monopolist's problem as a discrete-time Markov Decision Process and prove structural properties of the sales and production policy.

■ WD38

38- North 226 B- CC

Service Technology: Smart Services, Servitization, and Product/Service Solutions

Sponsor: Service Science

Sponsored Session

Chair: Helmut Aschbacher, Professor, University of Applied Sciences CAMPUS 02, Koerblergasse 126, Graz, 8021, Austria, helmut.aschbacher@campus02.at

1 - Smart Services – Implications and Approach for Agile Service Management
Helmut Aschbacher, Professor, University of Applied Sciences CAMPUS 02, Koerblergasse 126, Graz, 8021, Austria, helmut.aschbacher@campus02.at, Ernst Kreuzer, Christian Kittl

Smart Services are described in the literature as an ICT technique that identifies customer needs and issues fast service responses for increased convenience. The implications of smart services are not yet well understood as it is a management concept which has the power to revolutionize the agile delivery of services. A four-tier development approach, design patterns and the ethical implications of Smart Services will be discussed in this presentation.

2 - Servitization: The Role of Technology in Services Demonstrated by Logistics
Wei Xu, PhD Student and Teacher, University of Plymouth, School of Management Drake Circus, Plymouth, PL4 8AA, United Kingdom, wei.xu@plymouth.ac.uk, Daniel Berg

The role of technology in services has gotten increased academic attention after years of neglect. Systems technology such as logistics, has enabled increasingly,the servitization of manufacturing.This paper explores the changes underway and prospects for future impacts.

3 - An Efficient Service Policy for IaaS in Cloud Computing
Jin Young Choi, Associate Professor, Ajou University, San 5, Woncheon-dong, Yeongtong-gu, Suwon, Korea, Republic of, choijy@ajou.ac.kr, Moon-kyung Kim

We present an efficient heuristic policy for IaaS in cloud computing, while considering two objectives maximizing profits and minimizing customer's rejections simultaneously. It is examined for its performance by generating some example configurations, including IBM cloud computing services.

■ WD39

39- North 226 C- CC

Combinatorial Optimization

Contributed Session

Chair: Jiajin Yu, Georgia Institute of Technology, 266 Ferst Drive, KACB 2124, College of Computing, Georgia Tech, Atlanta, GA, 30332, United States of America, jiajinyu@gatech.edu

1 - Cyclic Best First Search for the 24-Puzzle
Edward Sewell, Southern Illinois University-Edwardsville, Dept. of Math and Stats, Edwardsville, IL, 62026, United States of America, esewell@siue.edu

We present a Cyclic Best First Search (CBFS) strategy as a heuristic for finding good solutions to the 24-Puzzle. The CBFS strategy is compared to one of the best heuristics, the Anytime Weighted A* (AWA*) search strategy. On a set of 50 benchmark problems, CBFS found the optimal solution of 33 of the problems versus 20 for AWA*. Furthermore, the average optimality gap for the solutions found by CBFS was 60% less than the gap for AWA*.

2 - Exact Combinatorial Branch-and-Bound for Graph Bisection
Renato Werneck, Researcher, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, renatow@microsoft.com, Daniel Delling, Andrew Goldberg, Ilya Razenshteyn

We present an exact algorithm for the minimum graph bisection problem: partition a graph into two equally-sized cells while minimizing the number of edges cut. Our algorithm is based on the branch-and-bound framework and is fully combinatorial. We present stronger lower bounds, improved branching rules, and a new decomposition technique. We can solve a wide variety of benchmark instances (many for the first time), including some real-world graphs with tens of thousands to millions of vertices.

3 - Online Candidate Problem and its Competitive Analysis
Yongfeng Cao, Student, School of Management, Xi'an Jiaotong University, Box2229,No.28, Xianning West Road, Xi'an, 710049, China, afengege@gmail.com, Yinfeng Xu

We consider a real-time version of the recruitment problem with candidate mechanism in which decisions as to who should be the candidates must be made in an online fashion. We consider two models in the research. First, for the One-Test model, we proposed the online strategy for one recruitment case and multiple recruitments case respectively. Second, for the Two-Test model, we gave the optimal online strategy and its competitive ratio for both no information case and semi-information case.

4 - Maximizing Submodular Function with Curvature and Its Application in Expected Utility Maximization
Jiajin Yu, Georgia Institute of Technology, 266 Ferst Drive, KACB 2124, College of Computing, Georgia Tech, Atlanta, GA, 30332, United States of America, jiajinyu@gatech.edu, Shabbir Ahmed

We give a simple analysis of the greedy algorithm for maximizing a submodular function with curvature under a cardinality constraint. We then extend the analysis to the knapsack constraint. We analyze the algorithm for an expected utility maximization problem within the sample average approximation setting.

5 - Robust Planning for an Open-Pit Mining Problem under Ore-Grade Uncertainty
Guido Lagos, Georgia Institute of Technolgy, 755 Ferst Drive NW, Office 426, Atlanta, GA, 30332-0205, United States of America, glagos@gatech.edu, Daniel Espinoza, Juan Pablo Vielma, Eduardo Moreno

Open-pit mining planning is a risky problem: high operation costs, many parameters are uncertain and the mining operation is done once. In this work we address uncertainty in the ore-grade and only assume the availability of i.i.d. samples. We consider an open-pit mining problem involving extraction and processing decisions under capacity constraints. We compare the performance of VaR, CVaR and a proposed robust optimization approach. The latter is shown to have desirable risk-averse properties.

■ WD40

40- North 227 A- CC

Smart Grids

Contributed Session

Chair: Prajwal Khadgi, Student, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, p0khad01@louisville.edu

1 - Scheduling in Smart Grids
Babak Zafari, PhD Student, George Washington University, 2201 G St. NW, Funger Hall 415, Washington, DC, 20037, United States of America, zafari@gwu.edu, Saba Neyshabouri, Goran Vojvodic

This paper aims at explaining the problem of scheduling appliances for a neighborhood in a Smart Grid environment. The problem has stochastic features, hence it is important to consider those in the optimization modeling process. In this work we use mixed integer stochastic optimization techniques and develop different multistage stochastic formulations for the problem. Several variants of the problem with different assumptions will be modeled and discussed.

2 - Market-based Scheduling of Flexible Demand and Renewable Supply in the Smart Grid
Philipp Ströhle, Karlsruhe Institute of Technology, Kaiserstrafle 12, Karlsruhe, 76131, Germany, philipp.stroehle@kit.edu

Future power systems dominated by fluctuating renewable energy sources call for a more flexible and responsive demand side. This work evaluates the effect of different degrees of demand side flexibility on social welfare in such power systems and compares continuous double auction (CDA) based scheduling to offline and online scheduling approaches. We find that the efficiency of the CDA-based scheduling can be improved by delayed bid-ask matching, rendering the approach economically useful.

3 - Evaluating Different Incentive-based Regulations for Residential Customers
Alireza Ghalebani, University of South Florida, 4202 E. Fowler Avenue, IMSE Department, Tampa, FL, 33620, United States of America, alireza@mail.usf.edu, Tapas Das

Using incentive pricing in a smart grid is an important feature of Demand Response program. In this paper, we have targeted residential customers and evaluated different incentive-based regulations in order to lower down the peak load using Reinforcement Learning. Some Experimental results are presented to show the best policy.

4 - Robust Pricing for Smart Grid
Yongma Moon, Professor, University of Seoul, Mirae Blg. 163 Seoulsiripdae-ro, Dongdaemun-gu, Seoul, Korea, Republic of, yongma@uos.ac.kr

Because of electricity shortage risk, smart grid power system has been highlighted. Using more flexible pricing strategy, such as Real Time Pricing, could enhance the efficiency of electricity system, as smoothing peak time demands which has uncertainty and risk. However, a risk-averse strategy for pricing electricity rarely has been studied. Therefore, this paper proposes the robust pricing strategy which could lead to efficient system and reduce the risk.

5 - Utilizing Multi-Attribute Utility Functions and Simulation to Model Load Leveling in Smart Grid
Prajwal Khadgi, Student, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, p0khad01@louisville.edu, Gerald W. Evans, Lihui Bai, PhD., Qipeng Zheng

Demand side management has gained much interest in recent advent of smart grid, due to load leveling and reduction in energy cost for consumers by altering consumer behavior via proper incentives. Most literature assumes cost is the only factor to determine consumer energy usage. We explore multi-attribute utility functions that consider both cost and convenience factors in modeling consumer behavior. Simulation is used to study the effect of the utility functions on load leveling in smart grid.

■ WD41

41- North 227 B- CC

Panel Discussion: ENRE - Analytical Challenges in the Petroleum and Petrochemical industry

Sponsor: Energy, Natural Res & the Environment/Mining

Sponsored Session

Moderator: Marlize Meyer, Principal Operations Researcher, Sasol Technology, 1 Klasie Havenga Street, Sasolburg, 1947, South Africa, marlize.meyer@sasol.com

1 - Analytical Challenges in the Petroleum and Petrochemical Industry
Marlize Meyer, Principal Operations Researcher, Sasol Technology, 1 Klasie Havenga Street, Sasolburg, 1947, South Africa, marlize.meyer@sasol.com

The Petrochemical and Petroleum environment is very complex with many components, products and interfaces. In 2011 Petrochemical and Petroleum analytics found a place as a subgroup in the ENRE section. Applying analytics consistently is a challenge in this diverse environment. A panel will discuss the challenges decision professionals face in this environment. Please bring your challenges and join in the discussion.

2 - Big Data In Energy Industry
Margery Connor, Senior Technology Strategist, Chevron, 6001 Bollinger Canyon Road, San Ramon, CA, 94588, United States of America, MHCO@chevron.com

This will be a discusson on how big data is impacting the petroleum and petrochemical industry. How are we using sensor data to gain insights?

■ WD42

42- North 227 C- CC

Storage of Energy

Contributed Session

Chair: Johann Hurink, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, j.l.hurink@utwente.nl

1 - Natural Gas Storage Decision Making
Ebisa Wollega, PhD Candidate, University of Oklahoma, 202 W.Boyd Room 431, Norman, OK, 73019, United States of America, ebisa@ou.edu, F.Hank Grant

In this presentation we describe an application of simulation modeling and optimization in natural gas storage decision making.

2 - A Battery Storage System for Peak Shaving and Time Shifting
Rajesh Tyagi, Scientist, General Electric Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, tyagi@ge.com, Xing Wang

We present algorithms for implementing a battery energy storage system for peak shaving to reduce demand charges and time shifting to reduce energy charges under variable pricing.

3 - Agent Based Micro-storage Management for a Hybrid Power System

Nicolas Lopez, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, nlopez3@miners.utep.edu

In the present paper, an agent based model is proposed to balance the electric storage in a Hybrid Power system, in our model, each house (end user) is modeled as an agent that can choose to either store or release electricity at different times in order to tail the demand with the objective of minimizing the total cost. The system is solved by pursuing to reach a Nash-Equilibrium with the inclusion of a genetic algorithm that minimizes the cost of electricity for the overall Hybrid Power System.

4 - The Value of Decentralized Storage

Johann Hurink, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, j.l.hurink@utwente.nl, Stefan Nykamp, Albert Molderink, Maurice Bosman, Gerard Smit

Storage in distribution grids is seen as an important element to integrate fluctuating feed-in caused by photovoltaic and wind generators. We derive optimal storage profiles for two different stakeholders (DSO and energy traders) using a case study with real world data. The results reveal a conflicting interest and show that unreasonable high costs occur with undesired welfare effects if no control or cooperation mechanism is implemented.

■ WD43

43- North 228 A- CC

Routing and Timetabling in Rail

Contributed Session

Chair: Yusin Lee, Professor, National Cheng Kung University, 1 University Road, Tainan, 701, Taiwan - ROC, yusin@mail.ncku.edu.tw

1 - MAX-MIN Ant System for Combination Scheme Optimization Problem in Railway Heavy-haul Transportation

Xuesong Han, University of Arizona, 540 E Grand Road, Tucson, AZ, 85705, United States of America, hxs2009@home.swjtu.edu.cn, Wei-Hua Lin

Max-min ant system for combination scheme optimization problem in railway heavy-haul transportation(SCCHP) is a new research area in railway transportation. In this study, a non-linear programming model is built and max-min ant system (MMAS) algorithm is used to solve SCCHP problem which has pretty good performance compared to GA based on priority-encoding.

2 - Solving Real-Life Railroad Problems: Block To Train Assignment and Train Routing

Shokoufeh Mirzaei, Wichita State University, 2608 W. Willow Lake Dr #131, Peoria, IL, 61614, United States of America, sxmirzaei@wichita.edu, Krishna Krishnan

Block to Train Assignment and Train Routing problems (BTRP),is the problem of finding the number of trains and their routes to transfer a set of blocks from their origins to their destinations with the objective of minimizing the total cost. In this paper, a heuristic algorithm is developed which solves BTRP cost and time effectively. The comparison of results with benchmarks shows that the heuristic provides the result promptly and with small deviation from the exact solution.

3 - A Novel Movement-planning Algorithm for Dispatching Trains on Rail Networks

Srinivas Bollapragada, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, bollapragada@research.ge.com

A movement plan is a detailed plan for moving trains in a rail network over a time horizon of 8 to 12 hours. It includes planning meet locations where trains traveling in opposite directions can get past each other as well as pass locations where fast trains can get past slower trains traveling in the same direction. We developed and implemented a novel algorithm at a major railroad company to automatically dispatch trains to increase average train velocities and save up to $800 million a year.

4 - Inserting an Additional Train into a Dense Timetable

Yusin Lee, Professor, National Cheng Kung University, 1 University Road, Tainan, 701, Taiwan-ROC, yusin@mail.ncku.edu.tw, I-Chang Chen, Shu-Keng Hsu, Hsiu-Hao Hsu, Chuen-Yih Chen, Hsiu-Mei Yu, Yen-Ju Lee, Cheng-Tao Yang, Li-Sin Lu, Jiun-Wu Yang, Mei-Ling Wu, Yen-Chieh Wang, Hsin-Tien Tsai

The problem of inserting an additional train into an existing timetable commonly arises in practice, yet is hard to solve. This work uses a shortest path model to identify possible paths for the additional train, and then uses linear programs to produce the new timetable. The model has the ability to adjust the given timetable, as well as track assignments of trains, to accommodate the additional train. Numerical cases based on a real system are solved in less than 20 seconds.

5 - Operational Performance of U.S. Public Rail Transit and Implications for Public Policy

Sreekanth Mallikarjun, PhD. Student, SUNY Stony Brook University, Department of Technology and Society, Stony Brook, NY, 11790, United States of America, sreekanth.mallikarjun@stonybrook.edu, Herbert Lewis, Thomas Sexton

In today's tough economic environment, it is critical that public rail transit systems be concerned with productivity and efficient use of resources, and seek ways to improve performance. This paper proposes a four-stage unoriented network data envelopment analysis (DEA) model to measure the operational performance of commuter rail transit systems in the U.S. over the last decade (2001-2010) and to identify the sources of inefficiency.

■ WD44

44- North 228 B- CC

Supply Chain: Issues with Shipping and Transportation

Contributed Session

Chair: Rafay Ishfaq, Assistant Professor, Auburn University, 415 W. Magnolia Ave, Suite 403, Lowder Business Building, Auburn, AL, 36849, United States of America, rafayishfaq@gmail.com

1 - Ports as Global Supply Chain Infrastructure: Why Asymmetric International Trade Structures?

John Liu, Professor, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, Hong Kong-PRC, liujjp@gmail.com

With containerization as core technology, global supply chains have evolved from a firm centric to a port centric structure, such as the walmart type that is founded on global outsourcing and contract manufacturing. We present a port enabled supply chain (PESC) model where production technologies are enabled by port(s). The PESC model explains why there have been imbalanced trade and asymmetric supply chain structures between developed North (US) and developing South (China).

2 - A Joint Production and Transportation Planning Problem under Heterogenous Vehicles

Aysegul Toptal, Bilkent University, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, toptal@bilkent.edu.tr, Utku Koc, Ihsan Sabuncuoglu

We consider the joint production and outbound-transportation planning of a manufacturer. The manufacturer has to schedule the processing and the delivery of orders to customers using a combination of heterogeneous vehicles. We propose different solution approaches based on how the underlying subproblems are solved. We provide intractability proofs or polynomial-time exact solution procedures for the subproblems. We also compare the different approaches over an extensive numerical study.

3 - Models for Supply-Chain Management of Containerized Imports from Asia to North America

Payman Jula, Assistant Professor, Simon Fraser University, 8888 University Dr, Burnaby, BC, V5A1S6, Canada, pjula@sfu.ca

Analytical models are introduced for predicting the allocation to ports and transportation channels of containerized goods. Assuming fixed distributions for container flow-times, the Long-Run Model heuristically solves a mixed integer non-linear program to determine the least-cost strategies. The Short-Run Model uses estimates of the flow times as a function of traffic volumes on fixed infrastructure to develop the best near-term strategies. The models are applied to industrial data.

4 - Impact of Hub Operations on Logistics Network Design

Rafay Ishfaq, Assistant Professor, Auburn University, 415 W. Magnolia Ave., Suite 403, Lowder Business Building, Auburn, AL, 36849, United States of America, rafayishfaq@gmail.com

In this research hub operations are modeled as a GI/G/1 queuing network with multiple shipment classes and deterministic routing. An integrated hub operation-network design model is presented. A study of real-world network explores issues related to network structure, total network costs, choice of different shipments and service performance.

5 - Metamodeling and Multi Axis Loss Function for Returnable Containers in Automotive Parts Supply Chain

Ahad Ali, Assistant Professor, Lawrence Technological University, 21000 West Ten Mile Road, Southfield, MI, 48188, United States of America, sali@ltu.edu

Manufacturing of automobiles is supported by shipping of supplier parts in returnable containers to assembly plants. This presentation discusses about the development of a stochastic container fleet planning methodology and characterization of the supply chain's total system cost. The research proposes on container resource planning; simulation with metaheuristic and metamodeling based on Steepest Ascent Method. Validity is done with Mixed Integer approach.

■ WD45

45- North 229 A- CC

Organization Theory

Contributed Session

Chair: Abey Kuruvilla, Assistant Professor, University of Wisconsin Parkside, Kenosha, WI, 53141, United States of America, abey.kuruvilla@uwp.edu

1 - Decision-making in Organizations: Selecting Polysemantic Laws

Alicja Reuben, PhD Candidate, Columbia Business Schoool, 3022 Broadway, 311 Uris Hall, c/o PhD Office, New York, NY, 10027, United States of America, apluta14@gsb.columbia.edu

This paper introduces the concept of polysemantic laws; statutes with multiple interpretations. Skilled prosecutors exploit polysemantic laws' varied interpretations to convict more defendants. Prosecutors do so to respond to media pressures, career aspirations, and their offices' economic constraints. We employ a dataset of federal criminal cases in order to explore the relationship between polysemantic laws and conviction.

2 - Should I Quit My Day Job? Real Options Insights and Hybrid Entrepreneurship

Joseph Raffiee, PhD Student, University of Wisconsin School of Business, Grainger Hall, 975 University Avenue, Madison, WI, 53706, United States of America, jraffieeshirazi@bus.wisc.edu, Jie Feng

A large number of individuals engage in wage work and entrepreneurship simultaneously- a situation termed hybrid entrepreneurship. Yet our understanding of the antecedents and consequences of hybrid entrepreneurship is remarkably sparse. Guided by real options theory, we use data from the National Longitudinal Survey of Youth (1979 cohort) and find support that hybrid entrepreneurship is a distinct organizational form with significant effects on full-time firm survival and performance.

3 - The Impact of Effectiveness of Ideation Phase of Innovation on Researchers' Collaborative Output

Oguz Cimenler, Industrial Management Systems Engineering, 14209 Knob Hill, Tampa, FL, 33613, United States of America, ocimenle@mail.usf.edu, Kingsley A. Reeves

This research investigates the impact of the structure of researchers' communication network on the structure of researchers' collaborative output network. Researchers' effectiveness in ideation phase of innovation is identified with three parameters: participation in "complete graphs", conversational churn rate, and self-perceived innovativeness score. Researchers' collaborative output network is constructed by using collaboration information obtained by a self-reported survey.

4 - Human Aspects of Operations Management – Cross Cultural Issues in Global Team Productivity

Abey Kuruvilla, Assistant Professor, University of Wisconsin Parkside, Kenosha, WI, 53141, United States of America, abey.kuruvilla@uwp.edu

This paper will discuss many of the key issues faced by global teams that are operating across cultures. An interview style research is conducted to look at the various issues faced in meeting productivity goals, deadlines and efficiency. Key cross-cultural business communication issues are presented and several solutions are then provided.

5 - Success Factors of Entrepreneurship in South East Asia

Mohammad A. Quasem, Department of Information & Decision Sciences, Washington, DC, United States of America, mohammadquasem@gmail.com

According to the encyclopedia, the word entrepreneur is defined as, "one who undertakes innovations, finance and business acumen in an effort to transform innovation into economic growth." The transformation of innovation into economic growth in south Asian countries has been conducted. The objective of this study is to show how the role of entrepreneurship has effected innovation and economic growth in south Asian countries. Its role in creating wealth and reducing unemployment will be studied. Additionally comparison studies of overall economic growth through entrepreneurship will be conducted.

■ WD46

46- North 229 B- CC

Traffic Flow Analysis for Network Modeling

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Alexander Paz, Assistant Professor, University of Nevada, Las Vegas, Civil and Environmental Engineering, Las Vegas, NV, 89154, United States of America, paz.alexander@gmail.com

1 - Lagrangian Traffic Flow Models in Dynamic Traffic Assignment

Stephen Boyles, Assistant Professor, The University of Texas, Austin, 1 University Station C1761, Austin, TX, United States of America, sboyles@mail.utexas.edu, Peter J. Jin

Existing application of Lagrangian traffic flow models in network modeling is limited to the link state estimation. In this study, we explore a more thorough integration of Lagrangian coordinates into dynamic traffic assignment formulations, such as route flow representation, estimating travel time sensitivity formulations, and other areas where tighter integration between the traffic flow model and equilibrium algorithm can prove beneficial.

2 - A Stochastic Macroscopic Model of Traffic Flow: Gaussian Approximation, Probabilistic Properties, and Estimation

Saif Jabari, University of Minnesota, 500 Pillsbury Drive SE, Dept. of Civil Engineering, Minneapolis, MN, 55414, United States of America, jabar005@umn.edu, Henry Liu

This research develops a Gaussian model of macroscopic traffic flow with time varying mean and covariance functions, which are given explicitly. We discuss the derivation of the model, its probabilistic behavior, and numerical schemes for computing traffic flow dynamics with applications to real-time estimation.

3 - Calibration of Microscopic Traffic Flow Models using a Bi-level Optimization Framework

Alexander Paz, Assistant Professor, University of Nevada, Las Vegas, Civil and Environmental Engineering, Las Vegas, NV, 89154, United States of America, paz.alexander@gmail.com

A Simultaneous Perturbation Stochastic Approximation (SPSA) algorithm determines a calibrated set of model parameters, using coefficients that affect performance in terms of convergence and quality. General guidelines are available to select numeric values of these coefficients; however, the SPSA algorithm often requires specific coefficients for each particular optimization problem. A bi-level optimization framework is proposed to calibrate model parameters and fine-tune the coefficients, using a fuzzy logic model.

4 - Network-level Reliability and Connection to Network Flow Theory

Hani S. Mahmassani, Northwestern University, Evanston, IL, 60208, United States of America, masmah@u.northwestern.edu, Tian Hou, Amin Saberi

Robust relations between travel time reliability and flow variables are established at the network level. The relations are validated using actual data and simulation results in several networks.

■ WD47

47- North 230- CC

Optimal Sensor Location

Sponsor: Transportation Science & Logistics/ Intelligent Transportation Systems (ITS)

Sponsored Session

Chair: Sushant Sharma, Purdue University, NEXTRANS, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu

1 - A Sensor Location Model to Optimize Bayesian OD Estimation

Pitu Mirchandani, Arizona State University, 699 South Mill Avenue, Tempe, AZ, 85287, United States of America, pitu@asu.edu, Ning Wang

The Sensor-Location Flow Estimation is a bilevel problem, where the upper level decides the optimum subset of links to locate counting sensors, and the lower level computes the best estimates of the flows of interest by using anticipated data from given candidate sensors locations. This paper proposed a sensor location model (upper level) when the lower level uses a Bayesian approach to update the prior distribution of OD volumes from observed link flows

2 - Sensor Location for Maximum Network Observability under Dynamic Traffic Conditions
Sushant Sharma, Purdue University, NEXTRANS, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu, Srinivas Peeta

This study addresses the network sensor location problem under dynamic traffic conditions. A theoretical model is proposed to determine the subset of links to install sensors on for maximum network observability in a given time horizon. The efficacy of the proposed model is demonstrated using a study network.

3 - Improving Observability and Controllability of Dynamic Traffic Systems using Sensor Networks
Kuilin Zhang, Argonne National Laboratory, 9700 S. Cass Ave. Bldg. 222, Lemont, IL, 60439, United States of America, kzhang@anl.gov, Xuesong Zhou

Observability and Controllability are mathematical duals in a system. We propose a novel model and innovative approach to identify the optimal sensor network design that can improve observability and controllability of dynamic traffic systems, whose observations are sufficient to detect traffic states for traffic information provision, and to estimate and predict dynamic traffic states such as origin-destination demand flows, traffic flows, and travel time, as well as whose control is sufficient to control the traffic system dynamics through integrated traffic control and management strategies.

■ WD48

48- North 231 A- CC

Facility Logistics VII

Sponsor: Transportation Science & Logistics/ Facility Logistics

Sponsored Session

Chair: Suzanne Marcotte, Professor, ESG-UQAM and CIRRELT, Dept. Management & Technology, P.O. Box 8888, Downtown Station, Montreal, QC, H3C3P8, Canada, marcotte.suzanne@uqam.ca

1 - Flow Balancing with Uncertain Demand for Cross-Docking Facilities
Luis Novoa, PhD Student-Decision Sciences, George Washington University, 2201 G Street, NW, Duquès Hall, Washington, DC, 20052, United States of America, ljnovoa@gwu.edu, Ahmad Jarrah, David Morton

Packages arriving at a facility are routed by primary sorters to secondary sorters based on the freight's final destination. We look at the problem of assigning package destinations to secondary sorters in a fashion that balances the workload within the facility while incorporating the day-to-day volume fluctuation. Robustness of the operation will be assessed based on solutions from a stochastic optimization model and a deterministic optimization one that assumes average package volumes.

2 - Robust Storage Assignment in Unit-Load Warehouses
Yun Fong Lim, Assistant Professor, Singapore Management University, 50 Stamford Road, #04-01, Singapore, SG, Singapore, yflim@smu.edu.sg, Melvyn Sim, Marcus Ang

Assigning products to and retrieving them from proper storage locations are crucial in minimizing the operating cost of a unit-load warehouse. We develop a robust optimization model to solve the problem with variable supply and uncertain demand in a multi-period setting. Our approach significantly outperforms existing methods in the literature.

3 - Optimization of a Distribution Center Yard: Trailer Flows and Layout
Suzanne Marcotte, Professor, ESG-UQAM and CIRRELT, Dept. Management & Technology, P.O. Box 8888, Downtown Station, Montreal, QC, H3C3P8, Canada, marcotte.suzanne@uqam.ca, Teodor Crainic, Maxime Durand

Distribution centers are important facilities in a distribution network. As opposed to many researches that focuses on optimizing the flows of goods inside a DC, our research focuses on the flows of the trailers that are handled in the DC yard. In our research, we first show how we have adapted Holodesign, an optimization tool to design robust facility layouts, to design the layout of the DC yard. We then show analytical results under various layout types using a Monte Carlo simulation.

■ WD49

49- North 231 B- CC

Urban Traffic Network Modeling

Sponsor: Transportation Science & Logistics/ Urban Transportation

Sponsored Session

Chair: Hong Zheng, Research Assistant Professor, University of Arizona, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, hzheng@email.arizona.edu

1 - A Class of Flow Splitting Models for Day-to-Day Traffic Assignment
Xiaozheng He, University of Minnesota, 500 Pillsbury Dr. SE, Minneapolis, MN, 55414, United States of America, hexxx069@umn.edu, Henry Liu

While the development of splitting rate model (Smith and Mounce, 2011) overcomes the unrealism in path-based models, it contains an ad-hoc step of flow adjustment, for the purpose of maintaining the flow conservation. In this talk, we propose a general formulation for a class of flow splitting models, which endogenously preserves the flow conservation. We also analyze the asymptotic stability of a flow splitting model, when we specify the outflow splitting function as a projection operation.

2 - On the Stability of a Boundedly Rational Day-to-day Dynamic
Xuan Di, University of Minnesota, 500 Pillsbury Dr SE, Civil Engineering, Minneapolis, MN, 55455, United States of America, dixuan@umn.edu, Jong-Shi Pang, Henry Liu, Jeff Ban

This paper provides the stability analysis for the boundedly rational day-to-day dynamic. TBR dynamic is a variable structure system consisting of multiple subsystems. Within each subsystem, the dynamic is linear time-invariant with exponential stability. Along the discontinuity surfaces between subsystems, the dynamic will slide along it and stabilize at one equilibrium. Therefore, the BR dynamic is asymptotic stable. A small network example is given to illustrate the stability analysis.

3 - Braess Paradox under Boundedly Rational Driving Behavior
Henry Liu, University of Minnesota, 500 Pillsbury Dr SE, Civil Engineering, Minneapolis, MN, 55414, United States of America, henryliu@umn.edu, Xuan Di

Classical Braess' Paradox demonstrates that, provided drivers are perfectly rational in choosing routes, the overall network performance might be worsened after a new road is added. However, many empirical studies show that drivers are boundedly rational. We study the properties of Braess' Paradox when bounded rationality driver behavior takes place. This paper explores under which condition Braess' Paradox will occur, when the travel demand and rational bounds are varying.

4 - Efficient Branch and Bound Algorithms for Solving Time-dependent Stochastic Shortest Path Problem
Xuesong Zhou, University of Utah, 110 Central Campus Dr., MCE 2000, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Lixing Yang

Several reformulations will be presented for finding the a priori least expected time paths in a time-dependent and stochastic network using a sample-based representation for link travel times. The proposed models can be easily dualized by a Lagrangian relaxation approach. A branch and bound based sub-gradient algorithm is developed to improve solution quality.

■ WD51

51- North 232 A- CC

Military Innovation using Optimization

Sponsor: Military Applications

Sponsored Session

Chair: Walt DeGrange, Naval Postgraduate School, 1411 Cunningham Rd., GL-254, Monterey, CA, 93943, United States of America, wcdegran@nps.edu

1 - Optimization of U.S. Army Battalion and Brigade Assignments
Javier Salmerón, Associate Professor, Naval Postgraduate School, jsalmero@nps.edu

The U.S. Army Training and Doctrine Command Analysis Center is investigating the problem of determining the best future mix of brigade combat teams (BCTs). Our optimization model examines how to assign individual battalion units and BCTs to missions over time in order to maximize the fit of those assignments across the force. The model accommodates the current Army Force Generation cycle for both active and reserve components. The study has been used to inform Army leadership decisions.

2 - Why Won't You Use My Model? Difficulties in Implementing Optimal Scheduling Models

Walt DeGrange, Naval Postgraduate School, 1411 Cunningham Rd., GL-254, Monterey, CA, 93943, United States of America, wcdegran@nps.edu

We have all been there. Spend months developing the perfect optimal scheduling model and after all this work the customer does not use the model and reverts back to legacy practices. What went wrong? This brief uses a recent Naval Postgraduate School / Military Sealift Command project (Replenishment at Sea Planner, RASP) as an example. Using this example, the brief walks through the pitfalls and possible solutions to the two step innovation process; invention and adoption.

3 - Optimally Locating Military Healthcare Virtualization Resources

Ayse Parlak, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, aip6@pitt.edu, Jeffrey Kharoufeh, Rusty Baldwin, Rocky Reston

We present integer programming models for optimally locating application virtualization hosting environments (AVHEs) at remote access sites across the military healthcare system. Considered are two objectives: (1) minimizing the total expected response time experienced by geographically-distributed users, (2) maximizing the probability that the response time at any site does not exceed a pre-specified threshold, subject to bandwidth and stability constraints.

■ WD52

52- North 232 B- CC

Renewable Energy Integration and Uncertainty Mitigation

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Zhi Zhou, Argonne National Laboratory, 9700 South Cass Ave., Argonne, IL, 60439, United States of America, zzhou@anl.gov

1 - Characterizing and Modeling Wind Power Forecast Errors from Operational Systems for use in Wind Integration Planning Studies

Bri-Mathias Hodge, Transmission and Grid Integration Group, National Renewable Energy Laboratory, 1617 Cole Blvd., MS 3811, Golden, CO, United States of America, Bri.Mathias.Hodge@nrel.gov

An important consideration in wind power integration studies is the role that wind power forecasting will play in simulated high-penetration system operations. As no wind power forecast is perfect, an understanding of the forecast error distributions that are observed in current system operations is important for modeling the forecast errors that can be expected in future scenarios. In this work, we statistically characterize and model the wind power forecast errors from three different operational forecasting systems at multiple timescales. Comparisons are made with two methods that are commonly used in wind integration studies to represent wind power forecasting: the persistence model, and an assumed normal distribution of forecasting errors. A number of model distributions are fit to the operational system forecast errors and the accuracy of the model fits to extreme events is examined in detail.

2 - Prediction of Power System Flexibility Requirements and Tail Events using Bayesian Network

Shuai Lu, Pacific Northwest National Lab, 902 Battelle Blvd, P.O. Box 999 MSIN K1-85, Richland, WA, United States of America, shuai.lu@pnnl.gov, Shuangshuang Jin, Yuri Makarov, Alan Brothers, John Pease, Craig McKinstry

Maintaining system flexibility to balance load and generation becomes more challenging with increasing penetration of PV and wind. This talk will present a Bayesian Network (BN) model for the prediction of real-time balancing requirements. The BN model captures the statistical relationship between generation/load imbalance and forecast errors, generation schedule control errors, as well as other factors, providing information to system operators to better manage system balancing reserves.

3 - Dynamic Scheduling of Operating Reserves in Electricity Markets with Wind Power

Zhi Zhou, Argonne National Laboratory, 9700 South Cass Ave., Argonne, IL, 60439, United States of America, zzhou@anl.gov, Audun Botterud

We propose a probabilistic methodology to estimate a demand curve for operating reserves representing the amount that a system operator is willing to pay for these services. The demand curve is quantified by the cost of unserved energy and the expected loss of load, accounting for uncertainty from generator contingencies, load and wind power forecasting errors. The methodology addresses two key challenges in market design: more efficient wind power integration and improved scarcity pricing.

■ WD53

53- North 232 C- CC

Envisioning the Next Generation of Power Markets: Pricing, Risk and Renewables

Sponsor: Energy, Natural Res & the Environment/Energy

Sponsored Session

Chair: Uday Shanbhag, University of Illinois at Urbana-Champaign, 206 Transportation Building, Urbana, IL, United States of America, udaybag@illinois.edu

1 - On Nash Equilibria in Duopolistic Power Markets Subject to Make-whole Uplift

Gui Wang, University of Illinois at Urbana-Champaign, 206 Transportation Building, Urbana, IL, United States of America, xjtu.wg@gmail.com, Sean Meyn, Uday Shanbhag

We consider a capacitated duopolistic power market, characterized by marginal cost pricing and make-whole uplift, in which firms bid offer functions. The characterization of equilibria proves challenging, particularly due to discontinuous payoff functions. Little is known regarding the nature of equilibria. Our study shows the following: When demand can be satisfied entirely by one of the generating firms, pure-strategy Nash equilibria arise; otherwise, mixed-strategy Nash equilibria exist.

2 - Minimum Uplift Assignment of Transmission Expansion Costs to Beneficiaries

Ross Baldick, Professor, The University of Texas at Austin, 1 University Station Stop C0803 ENS 502, Austin, TX, 78712, United States of America, baldick@ece.utexas.edu

In coming years, electric transmission networks will likely be expanded at an unprecedented rate to accommodate growth in renewables. In this work, we use a dual of the integer optimization problem of expanding transmission in order to set prices that "cover" as much of the total expansion cost as possible using linear prices. The remaining cost, due to the duality gap, could be socialized. Basic theory and several small examples will be developed.

3 - Packaging Energy and Reserves Bids in Co-optimized Multi-period Power Markets

Uday Shanbhag, University of Illinois at Urbana-Champaign, 206 Transportation Building, Urbana, IL, United States of America, udaybag@illinois.edu, Lindsay Anderson, Kyoungwon Kang, Judith Cardell

We examine the role of risk-based penalties in developing alternate market designs in which firms may combine energy bids associated with uncertain real-time availability with stable reserves bids. Such a framework is motivated by the reliability concerns associated with integrating volatile supply-side assets. Numerics on a 6-firm network illustrate the utility of such avenues.

4 - A Tri-level Transmission and Generation Expansion Planning Model for a Deregulated Market

Sarah Ryan, Iowa State University, Industrial & Mfg Sys Eng., Ames, IA, United States of America, smryan@iastate.edu, Shan Jin

We study a tri-level integrated transmission and generation expansion planning problem in a deregulated power market environment. Transmission expansion is considered in the top level as a centralized decision due to long planning/construction lead times and concerns for network reliability. In an EPEC subproblem, multiple gencos make their own generation expansion decisions subject to wholesale market equilibrium constraints. A hybrid iterative algorithm is proposed and applied in case studies.

■ WD56

56- Curtis A- Hyatt

Natural Resources

Contributed Session

Chair: Yousaf Shad Muhammad, Assistant Professor, QAU, Department of Statistics, Islamabad, Pakistan, yousaf@iot.ntnu.no

1 - Game Theory Based Mechanism to Incentivize a Switchgrass Ethanol Market

Yi Luo, University of Michigan, 440 Church Street, Ann Arbor, MI, United States of America, yiyiLuo@umich.edu

There are a variety of obstacles for cellulosic ethanol to reach the RFS goals. This paper explores an efficient incentive mechanism to encourage farmers and ethanol producers to participate in switchgrass growth and ethanol production. Game theoretic models are employed to predict the biomass and ethanol production decisions. A non-linear optimization model is developed to find the optimal monetary incentives to achieve the goals under future economic and technological conditions.

2 - Optimal Management of a Renewable Resource with a Supply Alternative

Karthik Murali, PhD Student, University of Illinois, Urbana-Champaign, 350 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, kmurali4@illinois.edu, Nicholas Petruzzi

We study the management of a scarce renewable resource when demand is endogenous and an expensive alternative source is available to supplement extraction. In this context, we determine the optimal procurement strategy, characterize sustainable equilibria, and explore the effects of limited alternative resource availability. Moreover, we compare the results for two different management motives – profit vs. social welfare, and comment on the relative desirability of each to the needs of society.

3 - Improving Fishery Management Models and Methods

Pall Jensson, Professor, Reykjavik University, Menntavegi 1, Reykjavik, 101, Iceland, pallj@ru.is, Ingolfur Arnarson

In this paper we integrate the product mix dimension and the concept of substitutability of economic resources into a classical bio-economic model. The results show that fishery management, which bases decisions solely on traditional bio-economic models where the dynamics of the decision processes of the industry are ignored, may reach decisions that are contra dictionary to their intentions.

4 - Stochastic Model for Optimal Crop Planning and use of Water Resources in a Riverbed

Yousaf Shad Muhammad, Assistant Professor, QAU, Department of Statistics, Islamabad, Pakistan, yousaf@iot.ntnu.no, Muhammad Rafaqat

We are planning a two stage stochastic model in a riverbed. In first stage, we balance the groundwater. The groundwater recharge consists of recharge from rainfall, irrigated fields and base flow from rivers. The groundwater discharge consists of draft from wells and evaporation. In second stage, we developed a stochastic optimization model for cropping and groundwater management. The objective is to maximize the annual return. Study area is Sargodha district of Pakistan.

■ WD57

57- Curtis B- Hyatt

Decision Support Systems II

Contributed Session

Chair: Mehmet Candas, Advisory Research Engineer, IBM Research, TJ Watson Research Center, Yorktown Heights, NY, United States of America, mfcandas@us.ibm.com

1 - Netchain: Hierarchical Model for Supply Chain Information Representation

Lei Liu, PhD Student, Arizona State University, 1709 S. Jentilly Ln, Apt. 87, Tempe, AZ, 85281, United States of America, lliu58@asu.edu, Amit Shinde, Mani Janakiram, George Runger

Business decisions, overall economy, and business events of competitor or major customer all impact product demand and need to be considered in a right forecasting model. A hierarchical Bayesian network structure is developed to summarize signals from a large set of information sources into limited number of representatives which forecasting model can incorporate. Experiments on representative and simulated data illustrate the advantage of the approach.

2 - A Decision Support System for Integrated Scheduling and Resource Allocation

Amir Ahrari, Faculty Research Associate, University of Maryland at College Park, 4329 Rowalt Dr., College Park, MD, 20740, United States of America, amir5862@yahoo.com, Ali Haghani

Common practice in scheduling is to priorities scheduling activities over resources. Since these phases are interrelated, optimizing them in an integrated stochastic optimization model not only improves the bottom line result but also demonstrates inferiority of the solution provided by traditional approaches. This model is proposed in this research.

3 - Needs Title

Siddhartha Sampath, Arizona State University, 849 W Elna Rae, Tempe, AZ, United States of America, Siddhartha.Sampath@asu.edu, Karl Kempf, Esma Gel, John Fowler

Many divisions at Intel every year are faced with the problem of deciding which projects to work on and which to shelve every year given a fixed budget.We managed to implement a tool in Matlab that provided an easy interface to planners and allowed them to visualize their data efficiently and play many what if games and also see how spending and revenue played out in the next few quarters.

4 - Utilizing Constraint Programming for Complex Systems Engineering

Merav Aharoni, IBM Research-Haifa, Haifa University Campus, Haifa, 31905, Israel, MERAV@il.ibm.com, Odellia Boni, Nir Mashkif, Yehuda Naveh, Aviad Sela, Fabiana Fournier, Uri Shani, Zvi Lando, Alon Modai

System engineering methodologies aim to decrease complex systems cost and time to market. Verifying methodology compliance of a system's design is limited, since relations among data residing in numerous tools are not recorded. We introduce a platform to manage these relations and a constraint programming application on top of it. Given a partial relations net, the application lists methodology violations or provides advice. The application was tested on an aerospace industrial example.

5 - PALM – Planning Analytics for Asset Lifecycle Management

Mehmet Candas, Advisory Research Engineer, IBM Research, TJ Watson Research Center, Yorktown Heights, NY, United States of America, mfcandas@us.ibm.com, Arun Hampapur, Shilpa Mahatma, Tarun Kumar

IBM is working with a number of cities on a 'First Of A Kind' engagement do build innovative analytics based solution for improving cross coordination among city agencies. These projects leverage a whole suite of complex OR models spanning both the operational coordination as well as long term multi-agency capital investment. The project has multiple use cases that include innovations namely: Day-to-day Operations Assessment, Smart Meter Analytics, Predictive Assessment & Investment Planning.

■ WD60

60- Remington- Hyatt

Aircraft Maintenance Operations

Sponsor: Aviation Applications

Sponsored Session

Chair: Nima Safaei, PhD, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, safaei@mie.utoronto.ca

1 - An Integrated Module for Aircraft Maintenance Routing and Work Packaging

Nima Safaei, PhD, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, safaei@mie.utoronto.ca, Andrew K.S. Jardine

The purpose of this study is to present an integrated decision module which covers the disadvantages of cyclic rotation, a dominant policy in the literature on aircraft maintenance routing. This module is to determine the week-length route per aircraft, consolidate the maintenance tasks into the work packages, and assign them to the maintenance opportunities existing in the route. Real datasets of different airlines are used to validate the applicability and performance of the proposed module.

2 - A Model Enhancement Heuristic for Building Aircraft Maintenance Personnel Rosters under Uncertainty

Philippe De Bruecker, KU Leuven, Naamsestraat 69-bus 3555, Leuven, 3000, Belgium, philippe.debruecker@econ.kuleuven.be, Erik Demeulemeester, Jeroen Beliën, Jorne Van den Bergh

This paper presents a heuristic approach for building workforce schedules at an aircraft maintenance company located at Brussels Airport. A model enhancement algorithm is proposed to minimize the labour costs under stochastic constraints. We illustrate the performance of the algorithm with a computational experiment and compare the results to other techniques. A simulation experiment proves that the achieved rosters can ensure the desired service level set by the company.

■ WD61

61- Russell- Hyatt

Homeland Security

Contributed Session

Chair: Heidi Taboada, Assistant Professor, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, hataboada@utep.edu

1 - Higher-order Latent Dirichlet Allocation with Nuclear Detection Data

Christie Nelson, Rutgers University, 640 Bartholomew Rd., Piscataway, NJ, 08854, United States of America, cgrewe@eden.rutgers.edu, William M. Pottenger

This research reports on the application of a novel statistical learning algorithm, Higher-Order Latent Dirichlet Allocation (HO-LDA), to improve the detection and identification of nuclear isotopes. We apply statistical relational learning space transforms to classify 17 different isotopes. The performance of using this relational information in our models is then compared with not using it to determine statistical significance of HO-LDA vs LDA when used on the nuclear detection dataset.

2 - Value of Intelligence on Terrorist Preferences

Onur Bakir, Assistant Professor, TOBB ETU, TOBB Ekonomi ve Teknoloji, Universitesi, Ankara, 06560, Turkey, nbakir@etu.edu.tr

In this talk, we consider a game between a terrorist and a state agent who allocates resources to protect certain assets from a terrorist attack. Our ourpose is to understand the value of intelligence regarding terrorist preferences and identify how it behaves as a function of critical factors in the game. We also evaluate the sensitivity of the value of intelligence to some critical parameters in the decision environment.

3 - On Coxian Phased Distributions in a Dynamic Reallocation Methodology for the Border Crossing Process

Hiram Moya, PhD Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843-3131, United States of America, Hiram@tamu.edu, Guy Curry

NAFTA trade was $914 billion in 2010, with 80% transported by commercial trucks through ports of entry (POE). Increased security requirements affect transit times. Previous models of the POE inspection time assume a Markovian distribution, but security procedures like dog sniffing create dependencies. This paper presents a Coxian k-phased approximation of inspection times, and compares against the exponential distribution using the Dynamic Reallocation Methodology to improve throughput.

4 - A Game Theoretic Approach to Risk Analysis in Ports and Waterways

Amir Ghafoori, PhD Student, Rutgers University, 23769 BP.O. Way, Piscataway, NJ, 08854, United States of America, ghafoori@eden.rutgers.edu, James T. Luxhoj

A mixed integer linear optimization model is developed based on a non-cooperative game theme. The players of the game are the attacker who tries to intrude into a body of water (port) and the defender who attempts to detect the attacker with the highest likelihood. The proposed optimization model seeks to allocate resources (sensors) in a set candidate points in the port to minimize the chances of successful terrorist attacks to the critical infrastructures bordering the port.

5 - A New Multiple Objective Evolutionary Approach for Intelligent Patrolling using Game Theory

Heidi Taboada, Assistant Professor, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, hataboada@utep.edu, Oswaldo Aguirre

In the present research, a new multiple evolutionary algorithm is developed to solve the patrolling problem considering multiple objectives. The problem was solved using a hybrid approach which combines an evolutionary approach and game theory concepts in order to define the multi-agent patrolling strategy which minimizes the maximum idleness, the infiltration ratio, and the cost of a specific patrolling strategy.

■ WD63

63- Borein B- Hyatt

Flow Shop Scheduling II

Contributed Session

Chair: Steve Sharp, University of Arkansas, Department of Industrial Engineering, Bell Engineering Center, Fayetteville, AR, 72701, United States of America, stevenson.sharp@gmail.com

1 - Heuristic Dynamic Programming for the Combined Car Sequencing & Level Scheduling Problem

Mesut Yavuz, Associate Professor, Shenandoah University, 1460 University Drive, Winchester, VA, 22601, United States of America, myavuz@su.edu

The combined car sequencing & level scheduling problem is an optimization problem arising in just-in-time production systems. The car sequencing component is an NP-Hard constraint satisfaction problem, prohibiting even finding a feasible solution in practical times. This study develops a heuristic dynamic programming algorithm that finds feasible solutions for real-size car sequencing problems as well as near optimal solutions for the combined problem in practical computation times.

2 - Robotic Cell Scheduling in Hybrid Flexible Flowshops

Gul Didem Batur, Gazi University, Industrial Eng. Department, Ankara, Turkey, dbatur@gazi.edu.tr, Serpil Erol

In this study we considered the scheduling problem arising in flow shops with multiple parallel machines per stage. Considered manufacturing cells produce a set of multiple part-types repeatedly and transportation of the parts between the machines/stages is performed by a robot. We focused on constant travel-time robotic cells, for which robot travel times between any two machines do not differ much from that between any other pair of machines.

■ WD64

64- Cowboy Artist- Hyatt

Reliability II

Contributed Session

Chair: Carlos Solorio, Assistant Professor, CETYS University, Calzada CETYS S/N, Col. Rivera, Mexicali, 21259, Mexico, carlos.solorio@cetys.mx

1 - Reliability of Multi-component System with Dependent Failure Processes and Dependent Damage Size

Sanling Song, PhD, Rutgers University, Rm201, Core Building, Busch Campus, Piscataway, NJ, 08854, United States of America, sanling@eden.rutgers.edu, Qianmei Feng, David Coit

We develop a new multi-component system reliability model, in which we consider dependent failure processes for each component, dependent component failure times and dependent damage sizes to two failure processes for each component caused by the same shocks. Shocks' effect on failure processes are correlated, and shocks effect all components. The component failure processes are competing and dependent. We demonstrate our model with a numerical example.

2 - Reliability of a Goods Distribution System under a Just-in-sequence Context: A Stochastic Approach

Jose Luis de la Riva-Canizales, National Council of Science and Technology, Ciencia y Tecnologìa 790, Saltillo 400, Saltillo, CO, 25290, Mexico, josedelariva@comimsa.com, Miguel Gaston Cedillo-Campos

Assessing the reliability of Goods Distribution Systems under a Just-In-Sequence approach means a robust analysis of service level and variation of the availability of system. Thus, a stochastic model to assess and foresee the dynamic behavior of variables in a sequential supply process in the automotive industry is presented. Based on operating times, the model provides information to decision-makers for reducing failures, and delivers an evaluation of socioeconomic impact of potential failures.

3 - Dynamic Reliability Upper Bounds on Customer-centered Performance Measures for Multi-state Systems

Carlos Solorio, Assistant Professor, CETYS University, Calzada CETYS S/N, Col. Rivera, Mexicali, 21259, Mexico, carlos.solorio@cetys.mx, Kailash Kapur

Traditional reliability models consider system performance as binary. Real life systems and their components can be modeled using multiple states of operation. Dynamic reliability upper bounds for the system are presented, because the complexity on computing the exact value grows exponentially. Upper Bounds for customer-centered performance measures are presented. The disutility function is also incorporated because it assigns an economic value. An infrastructure application is presented.

4 - Proportional Hazards versus Accelerated Life to Estimate Degree of Repair in Repairable Systems

Charles Love, Professor Emeritus, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5C1R5, Canada, love@sfu.ca

The purpose of this research is to estimate the repair effects in a repairable system. Data was collected on a cement kiln and causes of failure were identified as operational, mechanical or electrical. The unit was restarted but with an (expected) improved failure rate by virtue of the repair. Repair improvements are modeled in a Kijima virtual age framework. Covariate data was also used to compare proportional hazards versus accelerated life frameworks in estimating the failure/repair process.

■ WD65

65- Cassidy-Hyatt

Theory of Data Mining II

Contributed Session

Chair: Noam Goldberg, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL, United States of America, noamgold@mcs.anl.gov

1 - Iterative Search Algorithms for Geometrical Feature Extraction from Large Scale Point Clouds

Mark Haynes, Kansas State University, 200 Rathbone Hall, Manhattan, KS, 66506, United States of America, haynesmd@ksu.edu

Iterative optimization and search algorithms are ideal for the determination of geometrical statistics for surface metrological analysis. These algorithms have been applied in the analysis of various geometrical features of steel reinforcement wire. Raw surface profile information is collected via a Non-Contact Coordinate Measuring Machine. Statistics are iteratively calculated on a minimal zone criterion as is specified in the dimensioning and tolerancing guidelines provided by ANSI Y14.5M.

2 - Alternating Linearization for Structured Regularization Problems

Minh Pham, Student, RUTCOR, Rutgers University, 640 Bartholomew Rd., Piscataway, NJ, 08854, United States of America, ptuanminh@gmail.com, Andrzej Ruszczynski, Xiaodong Lin

We adapt the alternating linearization method for proximal decomposition to structured regularization problems,for instance,to the generalized lasso problem.The method is related to the well-known operator splitting methods but it has decent properties with respect to the objective function. We present the implementation for large problems,numerical results for several examples,including a three-dimensional fused lasso problem,which illustrate the scalability,efficacy,and accuracy of the method.

3 - Bayesian Kernel Models for Count Data

Hiba Baroud, Graduate Student, School of Industrial and Systems Engineering, University of Oklahoma, 202 W. Boyd St., Rm. 124, Norman, OK, 73019, United States of America, hbaroud@ou.edu, Kash Barker, Theodore Trafalis, Cameron MacKenzie

Bayesian kernel models, originally developed for updating Gaussian distributions, have been extended to other continuous non-Gaussian probability distributions. This work develops a kernel model for count data in which the Gamma conjugate prior is used with the Poisson likelihood function. Preliminary computational results are presented for several datasets and compared to other classical methods of modeling and forecasting count data, such as the Poisson generalized linear model.

4 - Preimages for Visualization of Variation Patterns from Kernel Distance and Bagging

Anshuman Sahu, Arizona State University, 936 S. Terrace Rd., Tempe, AZ, 85281, United States of America, anshuman.sahu@asu.edu, Daniel Apley, George Runger

Kernel Principal Component Analysis (KPCA) identifies nonlinear patterns in data. A challenge there is to estimate the preimage in input space. Since training data is noisy, we estimate the final preimage as the average from bagged samples drawn from the original dataset to attenuate noise in kernel subspace estimation. Our approach improves the robustness of any base KPCA algorithm towards the parameters. We demonstrate significant improvement over existing methods for digits and face datasets.

5 - A New Perspective on Sparse and Robust Support Vector Machines

Noam Goldberg, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL, United States of America, noamgold@mcs.anl.gov

We consider a convex relaxation of a sparse support vector machine (SVM) based on the perspective relaxation of mixed-integer nonlinear programs. We minimize the zero-norm of the hyperplane normal vector with a standard SVM hinge-loss penalty and extend our approach to the zero-one loss. The relaxation that we propose is a second-order cone (SOC) formulation; we compare properties and performance of the formulation with previous formulations and also consider a specialized algorithm.

■ WD66

66- Ellis West- Hyatt

Multivariate Statistical Analysis for Quality and Reliability Improvement

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jian Liu, Assistant Professor, The University of Arizona, Rm 221 ENGR Building, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, jianliu@sie.arizona.edu

1 - Statistical Methods for Degradation Data with Dynamic Covariates & Application to Outdoor Weathering

Yili Hong, Assistant Professor of Statistics, Virginia Tech, Department of Statistics, 213 Hutcheson Hall, Blacksburg, VA, 24061, United States of America, yilihong@vt.edu, William Meeker, Yuanyuan Duan

Degradation data provide a useful resource for obtaining reliability information. It is common nowadays to dynamically record usage and other environmental variables (e.g., temperature and humidity). We introduce a class of models for analyzing degradation data with dynamic covariate. We use general path models with random effects to describe degradation paths. The proposed methods are illustrated with an application for predicting life of organic coatings in a complicated dynamic environment.

2 - Identification of Nonlinear Causality for Prediction Based on Network Graph

Akkarapol Sa-ngasoongsong, PhD Candidate, Oklahoma State University, 245N. University Place, Stillwater, OK, 74075, United States of America, akkarap@ostatemail.okstate.edu, Satish Bukkapatnam

The concept of Granger-Causality has been broadly regarded as a powerful method, and widely used in time series research to determine a predictability of one variable to the others. However, one of the limitations of Granger-Causality is linearity assumption. In this presentation, we introduce a methodology to identify causal relationship of variables based on nonlinearity assumption and graph theory. A prediction application using nonlinear causality graph is also presented.

3 - Integrating Univariate Control Charts and Mahalanobis Distance for Near Zero TypeII Error Monitoring

Weihong Guo, PhD Pre-Candidate, University of Michigan, 1205 Beal Avenue, IOE Building, Ann Arbor, MI, 48105, United States of America, graceguo@umich.edu, Judy Jin, Tae Hyung Kim, Jack Hu, Mike Wincek, Hui Wang, Chenhui Shao, Patrick Spicer

It is highly needed to ensure high product quality through online sensing monitoring for emerging manufacturing processes especially in producing mission-critical parts such as rechargeable batteries for electrical vehicles. This research proposed an integrated monitoring scheme that targets at a near zero Type II error rate by integrating univariate control charts and Mahalanobis distance. The detailed algorithms and its implementation in a real-world example will be presented.

4 - Multivariate Statistical Process Control using Approximate Likelihood Ratio

Elsayed Elsayed, Rutgers University, 96 Frelinghuysen Road, Piscataway, NJ, United States of America, elsayed@rci.rutgers.edu, Abdel Magid Hamouda, Myong K (MK) Jeong, Khalifa N. Al-Khalif, Jinho Kim

In this talk, we present a new multivariate SPC (MSPC) chart for monitoring the mean vector change of a multivariate normal process. The chart utilizes an approximate likelihood ratio of a central and a noncentral chi-square distribution, which can be approximated by a central chi-square distribution having different degrees of freedom. We integrate the likelihood ratio into a multivariate CUSUM scheme for small shifts detection and provide performance comparisons with other MSPC charts.

5 - Bayesian Reliability Demonstration Testing of Hierarchical Systems

Jian Liu, Assistant Professor, The University of Arizona, Rm 221 ENGR Building, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, jianliu@sie.arizona.edu, Mingyang Li

System-level reliability demonstration testing is costly and one effective method of reducing the sample size is to construct informative prior for system reliability. This paper extends the Bayesian-based multi-level information aggregation approach to eliciting informative prior for the system. It aggregates reliability information of both prior knowledge and reliability test data available throughout the system. Numerical case study demonstrates the effectiveness of the proposed methodology.

■ WD67

67- Ellis East- Hyatt

Nanomanufacturing Processes and Systems: Modeling and Analysis

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Abe Zeid, Northeastern University, MIE Department, Boston, MA, United States of America, zeid@coe.neu.edu

Co-Chair: Sagar Kamarthi, Northeastern University, MIE Department, Boston, MA, United States of America, sagar@coe.neu.edu

1 - Multi Resolution Analysis for Modulus Prediction of PVA Treated Buckypaper

Arash Pourhabib, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States of America, arash.pourhabib@neo.tamu.edu, Yu Ding, Jianhua Huang, Kan Wang, Chuck Zhang

Buckypapers (BPs) are thin sheets produced from carbon nanotubes. To improve their mechanical properties, polyvinyl alcohol (PVA) is added during the manufacturing process. We present a multi-resolution model for analysis and prediction of Young's modulus of PVA-treated BPs. We utilize data from both the physical experiment and a simulation model. Introducing a latent variable which reflects the effectiveness of the PVA, we develop an algorithm which aggregates both sources of information.

2 - Computational Model of Molecular Beam Epitaxy (MBE) of MgO Growth on 6H-SiC Substrate

Abe Zeid, Northeastern University, MIE Department, Boston, MA, United States of America, zeid@coe.neu.edu, Sagar Kamarthi, Ghulam Uddin

Molecular beam epitaxy (MBE) of MgO on 6H-SiC is studied for effective integration of functional oxides. In this research we present the neural network assisted design of experiment (DOE) analysis of the growth rate of MgO films grown over 6H-SiC substrates. Based on the effective attenuation length (EAL) of silicon intensity we calculate the thickness of film under varying control variables.

■ WD68

68- Suite 312- Hyatt

Financial Modeling

Sponsor: Financial Services Section

Sponsored Session

Chair: Steven Kou, Professor, Columbia University, 312 Mudd Building, Department of IEOR, New York, NY, 10027, United States of America, sk75@columbia.edu

1 - Examples of Profit Distribution of Sequential Trades and Simultaneous Trades in Arbitrage Networks

Enyu Zhuang, PhD Student, City University of Hong Kong, Room 1101C, Hall 8, Student Residence, Hong Kong, Hong Kong-PRC, zhuang.enyu@gmail.com, Gang Feng

By regarding financial markets as nodes and arbitrageurs' cross-market trades as edges, an arbitrage network is built. These cross-market trades in the arbitrage network benefit the arbitrageurs and the investors in financial markets. However, the profit distributions of the arbitrageurs and the investors are different between two arbitrageurs' trading modes, i.e. sequential and simultaneous. Some examples are given to illustrate the difference.

2 - Argument Supremum of Subordinated Gaussian Processes with Negative Drift

Yuxing Luo, PhD Student, Washington State University, Dept. of Finance & Management Science, Pullman, WA, 99164-4746, United States of America, yluo@wsu.edu, Stergios Fotopoulos

The aim of this article is to develop a theory concerning the argument supremum of subordinated Gaussian processes. This includes obtaining exact Laplace transform of the argument supremum, its density and its stochastic representation. Theoretical results for the general case have been investigated for some of the well-known subordinators. The Barndorff-Nielsen and Shephard model, which has received much attention in the recent financial literature, is the central motivation for this article.

3 - The Effects of Executive Stock Option Grants on Financing Decisions

Kyoko Yagi, Akita Prefectural University, 84-4 Ebinokuchi, Tsuchiya, Yurihonjo, Akita, 015-0055, Japan, yagi@akita-pu.ac.jp, Ryuta Takashima

This paper considers the capital structure of a firm with stock option grants as managerial compensation in real options framework. We examine how the separation of ownership and control affects the firm's financing decisions. Especially, we analyze the effect of the stock option grants on capital structures and the share of stock option in managerial portfolios of firm's stock and options for financing with debt.

4 - Understanding the Patterns of Inter- and Intra-day Price Movements of Emerging Stock Markets in Asia

Yoon Hak Lee, KAIST, Yusung-gu Gusung-Dong, Daejeon, Korea, Republic of, yhl3145@gmail.com, WooChang Kim, Young Re Song, Yong Jun Yang

This paper explains the dynamics of inter- and intra-day return series of emerging stock markets in Asia by conducting hypothesis tests, regression analysis, and simulation while focusing on spillover and overreaction effects before and after the 2008 financial crisis. The results indicate a pattern specific to emerging markets in Asia; we find that a positive performance of the U.S. market has a larger effect on Asia markets than a negative one, which stands out from general market behavior.

■ WD69

69- Suite 314- Hyatt

Risk Management and Financial Regulation

Cluster: Risk Management

Invited Session

Chair: Xianhua Peng, Hong Kong University of Science and Technology, Department of Mathematics, Hong Kong, Hong Kong - PRC, maxhpeng@ust.hk

1 - The Impact of Volcker Rule on Bank Profits and Loan Prices

Sohhyun Chung, University of Michigan Department of Mathematics, 2074 East Hall, 530 Church St., Ann Arbor, MI, 48109-1043, United States of America, shholly@umich.edu, Jussi Keppo

We analyze the impact of Volcker rule by using a stochastic control model that we calibrate to a sample of U.S. banks. If a bank's trading alpha and its correlation between trading and banking cash flows are both zero then it is optimal for the bank not to trade at all. We estimate a simple worst case scenario by solving how much the banks should raise their loan rates to compensate the value decrease from the Volcker rule.

2 - Robust Risk Measurement and Model Risk

Xingbo Xu, Columbia University, 500 West 120th Street, Rm. 313, New York, NY, 10025, United States of America, xx2126@columbia.edu, Paul Glasserman

Financial modeling is subject to model risk, and it can be amplified by combining optimization. We use relative entropy and Alpha-divergence to quantify model risk, and convert expectation optimization problems into robust problems. We exam various financial models and their vulnerability to model risk, where we compare the nominal models, their worst scenarios and candidate perturbations. We find uncertainty in parameters inadequate to describe the worst scenarios in most cases.

3 - Loss-Based Risk Measures

Xuedong He, Assistant Professor, Columbia University, 316 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, xh2140@columbia.edu

Starting from the requirement that risk measures of financial portfolios should be based on their losses, not their gains, we define the notion of loss-based risk measure and study the properties of this class of risk measures. We characterize convex loss-based risk measures by a representation theorem and give examples of such risk measures. We then discuss the statistical robustness of the risk estimators associated a family of loss-based risk measures.

4 - Long-term Bank Balance Sheet Management: Estimation and Simulation of Risk-factors

Pedro Jùdice, Montepio Bank/ISCTE Business School, Rua Teòfilo Braga, 17, 7 dto, Coimbra, 3030, Portugal, pedro_judice@yahoo.com, John Birge

We propose a dynamic framework which encompasses the main risks in balance sheets of banks. Our contributions include solving a simple one-period model that describes the optimal bank policy under credit risk, and estimating and simulating the long-term stochastic processes for the balance sheet, taking into account the credit and interest rate cycles and short-term effects. Our results provide a basis for an optimization model to determine bank asset-liability management strategy endogenously.

■ WD70

70- Suite 316- Hyatt

Economics of Online Markets

Sponsor: Information Systems

Sponsored Session

Chair: Mingfeng Lin, University of Arizona, 1130 E. Helen St, Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu

1 - Online Social Influence and Borrowers' Default Decisions on Peer-to-Peer Lending

Bin Gu, Arizona State University, P.O. Box 874606, Tempe, AZ, 85287, United States of America, bin.gu.wp02@wharton.upenn.edu, Eric Lu

We assess social influence on borrowers' default decisions in a peer-to-peer lending market. We find that online borrowers are significantly influenced by default events in their social networks. A friend's default decision more than doubles a user's default rate. We also find that not all friends are equal. The social influence is only significant among online friends made through the peer-to-peer lending site. Social influence is not significant among offline friends.

2 - Analyzing the Interdependence between Web and Mobile Advertisements

Sang-Pil Han, Assistant Professor, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong-ROC, sangphan@cityu.edu.hk, Sunghyuk Park, Anindya Ghose

This study examines whether exposing users to Internet and mobile ads for the same product has a positive or a negative effect on consumer's affinity towards those products. Towards this end, we conduct large-scale archival data analysis, combined with randomized field trials in order to establish their causal relationships. Our results will provide valuable insights to advertisers as to whether/how they should engage in mobile and Web advertisings in a multi-channel environment.

3 - The Attention Economy: Measuring the Value of Free Goods on the Internet

Joo Hee Oh, Massachusetts Institute of Technology, Cambridge, MA, United States of America, jooheeoh@mit.edu, Erik Brynjolfsson

Free digital applications, from Wikipedia to Youtube, have proliferated on the internet. We develop a framework to quantify the value of free or low cost online applications using the insight that even when people do not pay cash, they must still pay "attention," or time, when consuming information services. We contrast the value of consumer surplus using two different methods, one based on the value of market expenditure, and one based on the value of time spent consuming free goods.

■ WD71

71- Suite 318- Hyatt

Software and Interconnectedness

Contributed Session

Chair: Ryan Panos, PhD Student, Arizona State University, 7802 E Diamond St., Scottsdale, AZ, 85257, United States of America, rpanos@asu.edu

1 - Smart Informatics through the Internet of Things

Benjamin Khoo, New York Institute of Technology, School of Management, P.O. Box 8000, Old Westbury, NY, 11568, United States of America, benksk@gmail.com

Automatic information services for Supply Chain Management are becoming a reality. Identification technologies, wireless sensor technologies, smart object technologies, nanotechnology and energy-scavenging technologies are packing more processing power into less space. All these developments will create an "Internet of Things" that connects and enables intelligent interaction between objects around the world that enable smart informatics.

2 - Iteration Length Tradeoffs in Agile Software Development

Ryan Panos, PhD Student, Arizona State University, 7802 E Diamond St., Scottsdale, AZ, 85257, United States of America, rpanos@asu.edu

In agile software development, we are seeking the tradeoffs associated with different iteration lengths under different conditions, in terms of project and product. An adaptable multi-criteria decision analysis guide would be provided to the industry to help predict quality, productivity, team stress, team motivation, technical debt and customer satisfaction.

3 - Innovative Success of Social Computing in New Product Development

Anita Lee-Post, Associate Professor, University of Kentucky, 425 Gatton Bldg, Lexington, KY, 40506, United States of America, dsianita@uky.edu, Pei Xu

We present an analysis of social computing in enabling new product development processes using a disruptive innovation success model. The model explains and predicts innovative success of social computing innovations under the lens of the theory of disruptive innovation. The applicability of the proposed model to analyze other key innovative initiatives that allows organizations to capitalize on the disruptive nature of a social computing innovation to achieve transformative growth is discussed.

■ WD72

72- Suite 322- Hyatt

Vehicle Routing with Environmental Considerations

Contributed Session

Chair: Andrzej Lewandowski, Optimization Software Architect, Red Prairie Inc., 20700 Swendon Dr., Waukesha, WI, 53186, United States of America, andrzej.lewandowski@redprairie.com

1 - Vehicle Routing Problem in Consideration of CO2 Emissions with a Loading Ratio

Takashi Irohara, Professor, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554, Japan, irohara@sophia.ac.jp

In this study, the vehicle routing problem to minimize the CO2 emissions with a loading ratio was modeled and it is formulated as a nonlinear programming problem. Simulated annealing based algorithm with the clustering indicator was proposed to find the eco-efficient solutions. The experimental results show that the proposed algorithm is more efficient than the conventional approach.

2 - A Dial-a-Ride Problem for Public Transport using Electric Vehicles

Weng Hei Tou, The Chinese University of Hong Kong, Rm. 615, M. M. W. Engineering Building, Hong Kong, Hong Kong-PRC, whtou@se.cuhk.edu.hk, Janny Leung

We study a variant of the Dial-a-Ride problem, using electric vehicles (EV), which aims to minimize the total distance travelled subject to meeting all customers' requests, and constraints on capacity, time-window, ride-time and battery-charging restrictions. Using EV limits the travelling time between battery recharges. The battery-charging constraints complicate the problem as extra variables and constraints are introduced. Computational results and further research directions are discussed.

3 - Environmental Vehicle Routing Problem

Georgios Saharidis, Lecturer, University of Thessaly, Leoforos Athinon, Pedion Areos, Volos, 38334, Greece, saharidis@gmail.com, George Liberopoulos

We propose a function, with static and dynamic inputs, to estimate an environmental externalities score (EES) for a link on a transportation network that can be used as part of the generalized cost function of transportation problems (e.g. environmental vehicle routing problem, environmental traveling salesman problem). EES is estimated for each vehicle, weight load and operating conditions, and depends on the traffic conditions, infrastructure profile, weather conditions and length of a link.

4 - Cost Optimization with a Congestion Charge Scheme for a Vehicle Routing Problem

Liang Wen, PhD Candidate, Lancaster University, Department of Management Science, Lancaster, LA1 4YX, United Kingdom, l.wen@lancaster.ac.uk, Richard Eglese

Two heuristic methods based on Dijkstra's algorithm are developed to find the minimum cost between two nodes in a time-varying road network where a Congestion Charge Scheme is applied. The heuristics are used within a full Vehicle Routing and Scheduling Problem to find the minimum cost plan for distributing goods from a distribution centre to a set of customers subject to a set of constraints. Results from a case study based on real traffic data in the London area are presented.

■ WD73

73- Suite 324- Hyatt

Topics in Scheduling

Contributed Session

Chair: Quoc Ho, Lecturer, HCM City International University, KP6, Linh Trung, Thu Duc, Ho Chi Minh City, Vietnam, hdquoc@hcmiu.edu.vn

1 - A Resource-Constrained Project Scheduling Problem with Continuous Time-Resource Curves

Daniel Steeneck, Doctoral Candidate, Virginia Tech, Virgnia Polytechnic Institute, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, steeneck@vt.edu, Subhash C. Sarin

We address a project scheduling problem under a single and limited resource type, which may be applied at varying consumption rates to its activities. We present a branch-and-bound method in concert with the solution of a nonlinear program to determine the sequence in which to perform the activities of the project and the resource consumption rate at which to process each activity so as to minimize the project duration.

2 - Improving the Performance of Sorter Systems by Scheduling Inbound Containers

Marco Schutten, University of Twente, Faculty of Management and Governance, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.schutten@utwente.nl, Niels Fikse, Sameh Haneyah

We investigate the inbound container scheduling problem for automated sorter systems, in two different industries: parcel&postal and baggage handling. We build on an existing algorithm and develop it to cover more realistic operational conditions. Furthermore, we provide two extensions to our algorithm and results of computational experiments. One of the extensions that we propose is the delayability extension. We find that this extension significantly improves the performance of the algorithm.

3 - Round Robin Sports Scheduling: A Survey of Models for the Minimum Break Problem

Athena Alimirzaei, SMU, 3850 West Northwest Hwy., #3407, Dallas, Te, 75220, United States of America, aalimirzae@smu.edu, Jeff Kennington

A round robin schedule with n teams (n even) is the one where each team plays one game per week over n-1 weeks. Each game is played on the home field of one of the teams. A break is defined as two home or two away games on consecutive weeks. In an ideal schedule, each team alternates between home and away games. We present a survey of various optimization models for solving the single round robin break problem with an empirical investigation using constraint programming and integer programming.

4 - Stochastic Job-shop Scheduling Problem: GA Approach.

Quoc Ho, Lecturer, HCM City International University, KP6, Linh Trung, Thu Duc, Ho Chi Minh City, Vietnam, hdquoc@hcmiu.edu.vn, Phong Ho

A modified Genetic Algorithms approach is used to determine the optimal solution for a job-shop scheduling with random processing times. Full active scheduling procedure is combined with a technique called Jumping Gene to reduce the search time. A mechanism to retain the fit chromosomes is also applied in this algorithm. The objective is minimizing the total completion time for all jobs. Some job-shop scheduling problems are used to test the efficiency of the modified GA approach.

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IS-M Interactive Session - Monday (12:30-2:30)
IS-T Interactive Session - Tuesday (12:30-2:30)

HAS Poster - Wednesday (11:00-12:30)
ENRE Poster - Sunday (4:30-6:00)
TSL Poster - Monday (4:30-6:00)

Candas, Mehmet WD57
Candogan, Ozan TD70
Caner Bulmus, Serra WD34
Cano, Emilio L. MC53
Cao, Junjie MA66
Cao, Qing TC71
Cao, Qingning SB27
Cao, Wenhua MA13, WA20
Cao, Wenwei SA61, SC19
Cao, Yongfeng WD39
Cao, Yuheng SC11
Capan, Muge TD24
Capar, Ibrahim HAS Poster
Capar, Ibrahim SC19
Capar, Ismail SD37, MB37
Caporossi, Gilles SB21
Capponi, Agostino SD73, MA73, MB73
Caramanis, Michael WC52
Cardell, Judith WD53
Cardoen, Brecht MA19
Cardoso, Goncalo MC53
Carl, Katherine SC17
Carlo, Hector TD48, WB48
Carlson, Lon TC69
Carlsson, John SC51, WA30, WC30
Carlsson, John Gunnar IS-M, IS-T
Carmeli, Boaz TD57
Carmona, Carmen SD02
Carnes, Timothy MD25, WC29
Carnovale, Steven MA39, WB44
Caro, Eduardo WB40
Caro, Felipe SA28, WA28, WB27, WC59
Carpenter, James TD20
Carpenter, Michael TB60
Carr, Robert TB21, TD18
Carr, Stephen MA51
Carrasco, Rodrigo MC14
Carrillo, Janice MB66, WD28
Carrillo, Victor WD18
Carstens, Gerhard WC41
Cartea, Alvaro WC69
Carter, Michael SA29, SB24, MD25, TC25, WC19
Carter, Rick TA17
Carvajal, Rodolfo TD22
Casbeer, David SD50
Cassioli, Andrea WA20, WB01
Castanier, Bruno TD17
Castillo, Ignacio MD20
Castrillón-Escobar, Andrés SA01
Castro Souza, Reinaldo SA01, MC55
Castro, Marco SB19
Casucci, Sabrina IS-M
Casucci, Sabrina WA19
Catalan, Andres MD39
Catalano, Marie TA03
Cataldo, Alejandro TB39
Çatay, Bülent IS-T
Catrileo, Favia SB39
Caudillo-Fuentesa, Luz A. MA36, WB36
Caughron, Brennan WA43
Caunhye, Aakil SA51
Cavaretta, Michael SC01
Cavdar, Bahar MC21
Cavdaroglu, Burak SB18
Cavdaroglu, Nur SC30
Cayirli, Tugba MA24
Ceder, Avi SC44
Cedillo-Campos, Miguel Gaston MA09, WD64
Ceglarek, Darek SD32, WB24, WC65
Çelebi, Dilay WD05
Çelik, Melih SC19, MB09, MD49
Celis, Elisa SB59
Cenk, Neslihan WA54
Centeno, Efraim SA52
Centeno, Grisselle WB19, WB65
Ceran, Yasin MD71
Cervellera, Cristiano SC07
Cesar Goez, Julio SB13
Cesaret, Bahriye SA09
Cetinay, Hande SD56
Cetinkaya, Elcin SB35, TA10
Cetinkaya, Sila SB27, SD26
Çeven, Erdem TC48
Çevik, Birsen IS-T
Ceyhan, Erkan TD25
Ceyhan, Gokhan MA17
Cha, Amanda TA38
Chachuat, Benoit WA01
Chacko, Josey MB08
Chadwick, Samantha TD69
Chai, Yueting SA69
Chakraborty, Arnab SC23
Chakraborty, Soumyakanti SB55
Chan, Carri MA58, MC24, MC29, MD29
Chan, Ethan MD18
Chan, Jennifer WC32
Chan, Lap Mui Ann MC44
Chan, Robert WB23
Chan, Tian TB34
Chan, Timothy SB25, SC17, MA13, MC52, TD29
Chan, Vivian TC60
Chan, Yupo TB37
Chandler, Phillip SD50
Chandra, Anca MA39, MB38
Chandrasekaran, Aravind SD34, MC20, TD56
Chang, Allison MB58, SC01
Chang, Byeong-Yun WB71
Chang, Chen-Wen TA20
Chang, Chia-Jung SC67
Chang, Chi-Chang SB04, TA20
Chang, Cindy MC58
Chang, Joseph WC39
Chang, Kuo-Hao MB18
Chang, Shing I. TC05
Chang, Tsung-Sheng WA72
Chang, Woojin SB68
Chang, Yanling WC61
Chang, Yu-Han MA03
Chang-Albitres, Carlos M. TC23
Chanta, Sunarin TA08
Chao, Raul TA34
Chao, Xiuli SA31, SB39, TA59, WB25, WB69
Chaovalitwongse, Art SC01, SD66, MC66, TA05, TC07
Chaovalitwongse, W. Art WD24
Chapados, Nicolas TB12
Chapman, Randall G. SD15
Chari, Manoj K. SD23
Chatrain, Baptiste SC61
Chatterjee, Indrajit TD46
Chatterjee, Samrat WC08
Chatterji, Aaron MB34
Chaturvedi, Aadhaar MA62, TC46
Chatwattanasiri, Nida WC62
Chaudhuri, Saikat TD56
Chauhan, Satyaveer S. TB41
Chavez-Bedoya, Luis MB69
Chayes, Jennifer MD58
Chee, Yi-Min WB02
Cheesebrough, Tony TA61
Chehrazi, Naveed MB68
Chen, Binchao WA73
Chen, Bintong TA35
Chen, Bo TD34, TD42
Chen, Boxiao (Beryl) SA31
Chen, Brian WD11
Chen, Chen MA69
Chen, Cheng-Bang MD44
Chen, Chien-Ming WB04
Chen, Chinghua TD25
Chen, Chuen-Yih WD43
Chen, Chun-Hung MD06, WB01
Chen, Chun-Miin TD33
Chen, David MD32
Chen, Dipeng TB69
Chen, Esther WA31
Chen, Eva MB02
Chen, Fangruo TA31
Chen, Feng WA73
Chen, Frank (Youhua) MC36
Chen, Guorong TC73
Chen, Hailiang SD70
Chen, Hanyi SB57
Chen, He TA32
Chen, Heng SB61
Chen, Hong MD19
Chen, I-Chang WD43
Chen, Jennifer TD04
Chen, Jian WA73
Chen, Jian WB39
Chen, Jianqing WA70
Chen, Jianshu WC10
Chen, Jie WA67
Chen, Jing TA35, TA35
Chen, Jingnan SC73
Chen, Kay-Yut MB63, MC63, TC63, WA17
Chen, Keith SD14
Chen, Lesley MA37
Chen, Li SA26, SB26
Chen, Li WC59
Chen, Liangpeng WC64
Chen, Lucy Gongtao SA17, TB36
Chen, Lujie WB66
Chen, Mengmeng WC57
Chen, Min WA71
Chen, Ming SB35, MC35
Chen, Nan SB67, MA67, WA67
Chen, Nan SC73, MA73, TA57, TB06, WC69
Chen, Pao-Lien SA46
Chen, Pei-Hua IS-T
Chen, Po-Hua WB69
Chen, Qin TC49
Chen, Qiong WB62
Chen, Rachel TB36
Chen, Richard TB21, WB22, WC22
Chen, Ruobing WD11
Chen, Ruoran SD05
Chen, Ryan SA60
Chen, Shaokuan TD46
Chen, Shaoxiang SD05
Chen, Shea SB68
Chen, Sheng-I TB19
Chen, Shenyuan MC10
Chen, Victoria SA07, SC07, TA40, TA52, TC66
Chen, Wei MC70, WC71
Chen, Wei TA68, WB68
Chen, Wei WC46
Chen, Wei WD32
Chen, Weiwei WB01
Chen, Wen TC36
Chen, Wenlin WB25
Chen, Wenyi SB33
Chen, Xi IS-T
Chen, Xi MB07
Chen, Xi SC06
Chen, Xi SC11, WA28
Chen, Xi SD06
Chen, Xiaoguang TD52
Chen, Xin SB31
Chen, Xin TB40, WB37, WD37
Chen, Xinyun TC57
Chen, Yan TA71
Chen, Yao TB04
Chen, Yibin SA62
Chen, Yi-Fen MB44
Chen, Yihsu TB40
Chen, Yikai MA42
Chen, Yin WA46
Chen, Ying SA47
Chen, Ying-Ju MD31, TD26, WB32
Chen, Yiwei MD46
Chen, Yonghong MD52
Chen, Yuche WD10
Chen, Yudong MC10
Chen, Yun IS-T
Chen, Zhi-Long MC35, MD14, TB14
Chen, Zisheng TB06
Chen, Zixiao TB55
Cheng, Changqing TB05, TB67, WA67
Cheng, Chun-Hung SC55
Cheng, Clark MC43, TA43, TD43
Cheng, Peng TD60, WA55
Cheng, Vincent CC MA66
Cheng, Yang SB47
Cheng, Yu-Hung SB04
Cheon, Myun-Seok SD06

Cheong, Taesu SC42
Cheriyan, Vinod SC68
Chernonog, Tatyana SD31
Cheung, Maurice WC73
Cheung, May TD02
Cheung, Yuen-Lam Vris TC13
Chevalier, Philippe SC57, TB26, WA14, WA44, WC44
Chew, Ek Peng SC06, MD06, TD14
Chhajed, Dilip TD39, WC39, WD34
Chhim, Peter MA32
Chi, Wei WB26
Chiam, Tze Chao WA19
Chiang, David WB69
Chida, Hidenori SC60
Chin, Chang-Ho SB04
Chin, Si-Chi MB66, MD07
Ching, Jacmara TB55
Chinnam, Ratna Babu MA32, MB25, MD19, MD39, TB49, TD46, WA38, WA62
Chinneck, John MC54, TB22
Chintagunta, Pradeep TC70
Chiraphadhanakul, Virot MC61, MD07, TA42
Chirkova, Rada WC13
Chiu, Yi-Chang SA49, SC47, SC49, MA49, TB42, TB47, TD47, WB47
Chmielewski, Hana SA09
Cho, Byung Rae WC05
Cho, Hyunbo SA44, SB56, WA22, WB13
Cho, Soo-Haeng SA55, MC28, TA32, TB26, WB26
Cho, Sugon TD66
Cho, Wendy WD08
Chockalingam, Arun TB57
Choe, Youngjun SD67
Choi, Byung K. MB19
Choi, Dong Gu SD37
Choi, Jin Young WD38
Choi, Min WC03
Choi, Ryan WD33
Choi, Sangdo MA44
Choi, Sungyong SD31, TA54, WB33
Choi, Thomas SA44
Chong, Jing WA45
Chong, Kenneth SA58
Chong, Linsen SB47
Choobineh, Fred MD06
Chou, Chun-An (Joe) SC01, TC07
Chou, Gloria SC01
Chou, Mabel SD29, TD14, WB46
Chou, Shih-Hsiung TC05
Chou, Yen-Chun SD39
Chow, Joseph Y.J. SA47, MD48, WA72
Chow, Vincent MD29
Chowdhary, Pawan WB71
Christianson, Kyle SB23
Chronopoulos, Michail MC69
Chu, Ching-Wu WB55
Chu, Jame CH MC23
Chu, Leon SB62, TB36
Chua, Geoffrey SD05, WB37
Chuang, Chia-Hung WD34
Chuang, Howard Hao-Chun SA29, SC38, SD39
Chukova, Stefanka WD22
Chun, SangIn SD04
Chun, So Yeon SA25, TD36
Chung, Casey TB18
Chung, Gunhui SA13
Chung, Sohhyun WD69
Chung, Sung Hoon MB44
Chung, Tim TC61, WD02
Chung, Yenho SD54
Chung, Yuho SC22
Church, Rick MD37
Chutani, Anshuman TD46
Cil, Eren SC29
Cimenler, Oguz WD45
Cimren, Emrah MC14
Cina, Majic WA19
Cincioglu, Derya WC73
Ciocan, Dragos Florin SB36
Cipriano, Lauren TD08
Cire, Andre MB21, TC12
Cisse, Adji SD20
Clark, Nicholas MC05
Clark, Scott MB01
Clarke, John-Paul TD60
Claro, João SB18
Claudio, David WB06
Clemen, Robert SB03, MB44
Clermont, Gilles WA06
Clewlow, Regina SD60
Coban, Elvin MA29
Cobb, Loren MB51
Cobuloglu, Halil Ibrahim MB41
Coburn, Andrew WB44
Cochran, Jeffery MD50
Codella, James TC19
Coe, Edwin TA19
Coello Coello, Carlos A. SA09
Coffrin, Carleton TB12, TC12
Cogez, Patrick SB14, WC56
Cohen, Maxime SA36, MB36, MD32, TB27
Cohen, Morris SD26, MD27
Cohen, Paul MC16
Cohen, Robin MD24
Cohen, Steven TB20
Cohen, Ted SA24
Cohn, Amy SA60, MC17, TA25, TC25, WA60, WB22, WC22
Coiro, Charles SD17
Coit, David SB67, SC05, MB53, MC41, MC67, WC62, WD64
Colacone, Antoinette MC24
Colatat, Phech WB56
Cole, Michael MA41
Cole, Wesley WC04
Coleman, Thomas TD72
Coles, John MA09, MB08, TA03
Collado, Ricardo TB72
Collamore, Jeffrey SC06
Collard, Jean TD54
Collin-Dufresne, Pierre MB69
Collins, Ine TC19
Collins, John TB71
Colosimo, Bianca M. SA05
Comm, Clare MD36
Conceição, Wellington SA56
Conejo, Antonio SD53, TC53
Conitzer, Vincent TB21
Conklin, W. Michael TB23
Connell, Steve TD61
Connelly, Elizabeth B. TB61
Connolly, Amy WA71
Connor, Margery WB41, WD41
Consortium, Microbiome SA07
Cont, Rama WB60
Contreras, Javier SA52, WB40
Conway, Chad TC30
Cook, Wade TB04
Cookson, Emily WA35
Cooper, Gregory WC07
Cooper, Orrin MD04
Cooper, William TB27, WC10
Cope, Dayana TB73
Corbett, Charles WA28
Cordeau, Jean-François MA48
Corley, Bill TC46
Corlli, L. SC60
Corlu, Canan MD08
Cornejo, David IS-T
Cornew, Dan SA02
Coronges, Kathryn TB50
Correa, Jose WD27
Correia, Gonçalo TA42
Correia, Paulo SC41
Corrente, Salvatore MD09
Cors-Lozada, Marco SA57
Cortazar, Gonzalo SD68
Costa Ferreira, Pedro Guilherme MC55
Costa Jr, Luiz Carlos SA53, TB53, WA53
Costanzo, Giuseppe T SD53
Côté, Murray WC20
Cotton, Tanisha SD25, WA10
Coudert, Tony MC62
Couet, Benoit MD18
Coulon, Michael TC68
Coulter, Robin SC04
Courty, Pascal SC26
Cousin, Areski MC73
Covarrubias, Daniel WC37
Cox, Christopher SC50
Cozad, Alison MD18
Craft, David SB25
Craig, Nathan TC27
Craig, Tim SB25
Craig, Tony MB33
Crainic, Teodor MC49, MD48, TB49, WD14, WD48
Crama, Pascale TB30, WC35
Craparo, Emily MC50
Crawford, Beth WC20
Crawford, Elizabeth TB24
Creedon, Jerry MB60
Crepey, Stephane MC73
Crespi, Giovanni WC18
Crespo Pereira, Diego MA18
Cronin, Paul TB44
Crook, Jonathan WB04
Crossley, William TC60
Cruz, Jose SA33, MA31
Cuervo, Pablo ENRE Poster
Cui, LiYing MA39, MB38
Cui, Ruomeng SA26
Cui, Tony MB63
Cui, Yao SC35
Cui, Zhijian MA56, TC56, TD27
Cunningham, Kevin MB72
Cure, Laila SC45
Currence, Jeremy WA45, WC23
Curry, Guy WD61
Curry, Susan TA23
Curtis, Frank TB11, WA11
Cyrino Oliveira, Fernando Luiz MC55
Czerwinski, David WA42
Czyzyk, Joseph WB41

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Dada, Maqbool SB30
Dahlgren, Eric SB34
Dai, J.G. "Jim" MA58, MC57, WB59
Dai, Min WA68, WC69
Dai, Tinglong HAS Poster
Dai, Tinglong MA17, TA32, TB24
Daily, Bethany WC29
Daim, Tugrul WA56
Dalal, Jyotirmoy SB49
Dalkiran, Evrim MD01, MD19, MD39, WD18
Dallery, Yves WB57
Dalton, Chris SC02, MA15
Dalyanoglu, Mürsel IS-T
Damci-Kurt, Pelin MA12
Damien, Paul MB18
Damonte, Taylor SA21
D'Amours, Sophie TA41, TB41, TC41
Danandeh, Anna TA53, WA44
D'Andrea, Raffaello WC34
Dandurand, Brian TA09
Dang, Chuangyin TC46, WA46
Dang, Cong TA11
Daniel, K. TA42
Daniel, Kent MB69
Daniels, Matthew TD69
Daoud, Slim SB32
D'Arcy, John MB71, TA71
Darroudi, Ali IS-M
Darwish, Saied SB32
Das Gupta, Aparupa SB38, WC59
Das, Abhishek SD32
Das, Devashish WA05
Das, Tapas SB24, MC52, TA20, TB19, WD40
Dasgupta, Tirthankar SA67, TA67
Dash, Sanjeeb SB12
Dashty Saridarq, Fardin WC43
Daskin, Mark TA25, TA37, TB55
Dasu, Sriram MD44, WA63
Date, Ketan WA37
Date, Paresh SA11
Datta, Partha SD38
Davendralingam, Navindran TD17
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David, Amy WA17
Davies, Jane SC56
Davila, Marbelly WB65
Davis, Andrew TD63
Davis, Ashley TA25
Davis, David MD51
Davis, James TC35
Davis, Lauren IS-M

IS-M Interactive Session - Monday (12:30-2:30)
IS-T Interactive Session - Tuesday (12:30-2:30)

HAS Poster - Wednesday (11:00-12:30)
ENRE Poster - Sunday (4:30-6:00)
TSL Poster - Monday (4:30-6:00)

Davis, Lauren MD08, WC08
Davis, Mark SD54
Davis, Michael WA65
Davis, Ronald SB14
Davis, Steve SB02
Davoodi, Maziar IS-M
Dawande, Milind SA09, SA55, MA33, MA40, TA14, WD32
Dawud, Rana WC66
Day, Robert SD62
Dayanik, Savas WA54
Dayhim, Muhammad MA41
De Boeck, Liesje TC73
De Bruecker, Philippe TC73, WD60
De Castro, Luciano MD62, TB62
De Cicco, Micheal TC67
de Farias, Ismael TD13
de Jong, Jurriaan TA44
de Jonge, Bram WD05
de Kok, Ton SC48
De Koster, René SD57, TB48
de la Cruz, Jen Ai SA73
de la Riva-Canizales, Jose Luis WD64
de la Torre, Luis MD49, WC32
de Matta, Renato MA31
De Meyer, Arnoud SC34
De Reyck, Bert MC69, WB18
de Rezende, Pedro SD12
de Sousa, Amaro SA23
de Souza, Cid SD12
de Vericourt, Francis WA36
de Vries, Harwin WA34
de Weerdt, Mathijs TB71
de Wolf, Ronald SD12
De, Prabuddha SD70
Deak, Istvan SC10
Deal, Robert TA41
Deb, Kalyanmoy SC09, WA09
Debo, Laurens MA26, MA28, MD28, TA31, TB31, TC26, TD26, WC31, WD27, WD31
DeCampos, Hugo WC44
DeCarolis, Joseph SA40
Deckro, Richard F. MA51
DeClerck, Dennis TC14
DeCroix, Greg TB33
Deeds, Paula SA05
Dees, Robert TA19
Deflem, Yannick MD33
Defourny, Boris SD52, TA72, TC72
Degel, Dirk TB46
Deglise-Hawkinson, Jivan WC29
Degraeve, Zeger TC33, WB18
DeGrange, Walt WD51
Dehghani, Ahad SB13
Dehghani, Saeed WB42
Dehghanian, Amin WD25
Dehnokhalaji, Akram MC09
DeHoratius, Nicole SC38, WA31
Dekker, Rommert WA34
del Castillo, Enrique SA05
del Rio Vilas, David MA18
del Valle, Alejandro G. MA18, WC72
del Villar, José Ignacio TC55
Delahaye, Thierry SC61
Delasay, Mohammad SC63
DeLaurentis, Daniel SD60, TC60, TD17
Delen, Dursun SB66
Deleris, Lea MD02, WB02
Delgado, Daniel SB18
Dellaert, Nico SC48
Dellana, Scott WB03
Delling, Daniel WD39
Demeulemeester, Erik MA19, TC14, TC73, TD19, WD60
DeMiguel, Victor SC69, TA69, WA26, WC28
Demirel, Edil TC73
Demirezen, Emre MD39, TC20, WC70
Demirkan, Haluk SC39
Demirtas, Derya TD29
Demiryurek, Ugur SC42
Deng, Changrong MC62
Deng, Na TA48
Deng, Shijie MC69, WB59
Deng, Tianhu MB14
Deng, Wei TB11
Deng, Wen MB47
Deng, Xiaotie TD34
Deng, Xinwei SA67, MD05, TB05
Dengiz, Berna TA06
Denholm, Paul SC52
Denomme, Carolyn MB66
Denton, Brian MA25, MB23, MD72, TA29, TB45, TD72, WD20
Deo, Sarang SD03, SD29, MC29, TA32, TB29, TC28
Derby, Stephen MA02
Derigs, Ulrich TC60
Desai, Jitamitra MC01
Desai, Vijay SA37
Deschamps, Frederic SB23
Deshmukh, Abhijit TB19
Deshpande, Ajay WC52
Deshpande, Vinayak SA60, SD61
Desmeules, Remi SA71
Desmond, Jeffrey MC24
Desnoyers, Neil WB17
Dessouky, Maged SA19, SB48, TA42, TC49, TD40
Dessureault, Sean SA67, WB07
Dettenbach, Marcus TC33
Deutting, Paul SD62
Devalkar, Sripad TA27, TA30, TB30, WD32
Devlin, Anna WB28
Devolder, Olivier MB13
Devulapalli, Raghuveer IS-M
Devulapalli, Raghuveer SC51
Dewan, Sanjeev MA70
Dey, Anind WA57
Dey, Debabrata TC24
Dey, Santanu SB12, MA12, MB12, WB12, WC12
DeYong, Gregory SD51
D'Haen, Jeroen WA64
Dharmadhikari, Nimish IS-T
Dhurandhar, Medha HAS Poster
Di, Xuan WD49
Diaby, Moustapha SC11
Diamant, Adam WA58
Diana, Tony MA61, MB60
Diao, Guoqing SC06
Diao, Yixin TD23
Dias, André SA53, SD01
Dias, Bruno WC04, WD11
Dias, Jose Carlos TA73
Dias, Luis MD09
Diaz, Santiago TB55
Dickerson, John MC62, MD72
Dickson, John TA40
Didenko, Vladimir WA09
Diehl, Kathleen TD24
Dieker, Ton MA59, WB59
Dilkina, Bistra SD40
Dillon, Robin MB03
Dimitrov, Nedialko WD22
Dimitrov, Stanko WD22
Ding, Hongwei SA69, WA42, WB34, WC57
Ding, Jing TD47
Ding, Jun SD42
Ding, Qing MC30
Ding, Yichuan TD25, WA54
Ding, Yu MC67, TA03, WA67, WB54, WD67
Dininger, Steve SD02
Diniz, Andre Luiz SB40, TB53
Dinwoodie, Ian IS-T
Dinwoodie, Ian WD07
DiRenzo, Joseph MA23, TA03
Dirkse, Steven MB72
Dirnberger, Jeremiah MC43
Divan, Deepakraj SD37
Diwekar, Urmila SC41, TD20
Dixon, Danny WA25
Djimadoumbaye, Noubara SD67
Djulbegovic, Benjamin TD20
Do, Gilhyun WB13
Doan, Kien SD47, TA47, TA49, TB47
Doan, Xuan Vinh TD42
Dodin, Bajis SB14
Dogru, Mustafa SD33, MC53
Dokka, Trivikram MD23
Dolgun, Leman Esra MB09
Dolinskaya, Irina MA50, MC48, MD49, TC52, WC32
Donaldson, Logan TB13
Dong, Fang SC29
Dong, Hongbo MC12
Dong, Hui MC44, TB39
Dong, Jin SA69, TD50, WC57
Dong, Jing TB31
Dong, Jing WA49
Dong, Jingyan TB67
Dong, Lingxiu SB30, MA30, TB30
Dong, Yuanyuan TB39
Dong, Yue HAS Poster
Donnell, Drew TD20
Donohue, Karen SD44, MB63
Donovan, Kenneth SB51
Doolittle, Erin TA09
Dornfeld, David MB44
Doro-on, Anna SC51, SD51
Doroudi, Sherwin MD58, TD58
Doucette, Emily MB50
Dougherty, Deborah SD46
Downes, Patrick TA50
Drake, David WA28
Drakopoulos, Kimon MC58, TC54
Dresner, Martin MA60
Drew, Rachel TC08
Drezner, Tammy WA37
Drezner, Zvi TD37, WA37
Driscoll, Patrick TC50
Dror, Moshe SC17, SD26
Druehl, Cheryl SA71, MD34, TB56, TC34
D'Souza, Warren MA13
Du, Lili WB47
Du, Linna SB72
Du, Longyuan TD49
Du, Yuquan TA48
Duan, Rong TB66
Duan, Weitao MC06
Duan, Wenjing TC71
Duan, Yuanyuan WD66
Dube, Parijat SA35, SD36, MB35
Dubrawski, Artur TA66, WA66, WB66, WC07
Duenyas, Izak SA62, SB39, SC35, SD44, TB28, WB25
Duke Kominers, Scott MB62
Dula, Jose WA04, WC17
Dulgeroglu, Onur I. MB23, TB23
Dulin, Johnathon SB51, SD38, TB51, WA38
Dumkrieger, Gina WB19
Dunn, Peter WC29
Durand, Maxime WD48
Durango-Cohen, Elizabeth TD45
Durango-Cohen, Pablo MA42
Dussault, Benjamin TD42
Duthie, Jennifer MC42
Dutta, Goutam SA55, SB55
Duygu, Mustafa IS-T
Dyer, James SA04, SC30

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Easa, Said SD42
Eaton, Jeff WB51
Ebadian, Mahmood TD52
Eboch, Karen TC17
Ebrahimi, Nader MB67
Eckhardt, Jon MB34
Eckhause, Jeremy WA38
Eckstein, Jonathan SA10, TA13, TD18
Edgar, Thomas WC04
Edmunds, Thomas WC40
Eftekhar, Mahyar MA08
Egan Warren, Sarah TC17
Eglese, Richard WD72
Ehlers, Kurt SA41
Ehmke, Jan Fabian TB49
Eiselt, H. A. MD37
Ejaz, Fariha WB65
Ekici, Ali SA19, SD12, MC49

Ekin, Tahir SA11, TA07
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Elvira, Veronica SD02
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Fletcher, Hilary TB50
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Galindo, Gina SA51
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Güngör, Zülal IS-M
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Hammond, Robert MA62, WA02
Hamouda, Abdel Magid SB67, SC05, WC60, WD66
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Hamzeei, Mahdi MC12
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Han, David WB64
Han, En-Pei SD60
Han, J. TD13
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Haouari, Mohamed SB61, TA12, WB14
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Harada, Kouhei TD73
Harasic, Oscar TB55
Harchol-Balter, Mor MD58, TD58
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Hart, William E. MB22, MC22, MD22, TD18
Hartikainen, Markus E WD09
Hartke, Rafael SA15, TD69
Hartley, Dean MB51, MC51
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Hartman, Joseph SD12
Haruvy, Ernan SC26
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IS-T Interactive Session - Tuesday (12:30-2:30)

HAS Poster - Wednesday (11:00-12:30)
ENRE Poster - Sunday (4:30-6:00)
TSL Poster - Monday (4:30-6:00)

Heinz, Stefan TC18
Heipcke, Susanne SA72
Heitmann, Henrik WA13
Heitz, Christoph MD38, TB38
Helfat, Constance TC34
Hellemo, Lars SB53
Heller, Katherine TC07
Heller, Stephanie TA19
Helm, Jonathan HAS Poster
Helm, Jonathan SA06, SA08, SB08, MC25, MC29, WC29
Hemm, Robert WA38
Hemmati, Soheil SD22, WB21
Henao Botero, César Augusto IS-T
Henderson, Shane SA58, SC59, MD06, MD25, WA29
Hendricks, Kevin TC44
Henrion, Max MD55, SB02, WA40
Henry, Andrea MC31
Heo, Jun-yeon SA34
Heo, Yeonsook MD53
Heragu, Sunderesh MA67, TA06, TC48, TD19, WA24, WD13
Heras, Raul TB46
Herbertsson, Alexander MC73
Herbsleb, Jim SD34
Herer, Yale T. MD30
Hering, Amanda MB51, TB53
Herman, Jon TC09
Hermel, Dror MD35
Hernandez, Aida Mercado SB04
Hernandez, Alejandro MC51
Hernandez, Ivan SB31
Hernandez-Coronado, Pablo SD02
Herndon, Benjamin SC46
Herraiz, Esperanza SD02
Herrera, Tulia MD14
Herrera-Restrepo, Oscar MA18
Herrmann, Jeffrey MB04
Herrmann, Philipp SD71
Hershkowitz, Martin SC51
Hertz, Alain SB21
Hertzler, Erik SB23
Hess, James SB66
Hesse, Rick WC17
Hewitt, Mike SC19
Heydar, Mojtaba TB43
Heydari, Ruhollah WA30
Heydt, Gerald ENRE Poster
Heydt, Gerald IS-T
Heydt, Gerald SA41
Hicham, Chehade SB32, MA32
Hickman, Mark SA49, SC49, SD49, MD42
Hicks, Illya SD21, WA12
Higgins, Matt MD60
Higle, Julie SD45
Hihara, Katsuya WA55
Hill, David MA41
Hill, Shawndra MB58, TB70, WD07
Hillard, Dustin TA62
Hillson, Roger MD51
Hines, Wes WB64
Hinojosa, Yolanda MA37
Hirotsu, Nobuyoshi MA45
Hirsch, Michael MB50, WB01
Hirsh, Haym TB58
Hitsch, Guenter TA25
Ho, Phong TD30, WD73
Ho, Quoc TD30, WD73
Ho, Teck-Hua MD63
Ho, Yichun MD70
Ho, Yijen MA70
Hoang, Oanh (Olivia) IS-T
Hobbs, Benjamin SB03, MB53, WB53
Hobby, John SD33, MC53
Hoberg, Kai TC44
Hobson, Stacy SD38
Hochbaum, Dorit S MA21
Hodge, Bri-Mathias WD52
Hoen, Kristel SC33
Hoetker, Glenn SA46
Hoey, Jesse MD24
Hoffer, Paul TB42
Hoffman, Karla MC62
Hohjo, Hitoshi MB59
Holburn, Guy SA56
Holder, Allen MC54
Holguin-Veras, Jose TB46
Holguín-Veras, José TSL Poster
Holl, Jane TA25
Holland, Eric SD03
Hollander, Justin TC08
Hollifield, Burton SA68
Hollywood, John WC08
Holmes, John MB58
Holodniy, Mark TD08
Holt, Luke IS-T
Holt, Luke TD07
Hom, Daniel TD15
Honappa, Harsh MA57
Hong, Mingguo SD52, TD53
Hong, Yili WD66
Hong, Young-Chae TC25
Hong, Yuan MD66
Hong, Yu-Ju SD36
Honhon, Dorothee MD26, TA02
Honka, Elisabeth TC70
Hooker, J.N. MA29, MB21
Hopp, Wallace MC24
Hopper, Timothy MB29, MC72
Hora, Manpreet SA44, SB44, SC34, MB40, TD17
Hora, Stephen MB02, WD02
Horn, Abigail IS-T
Horton, Steven TB50
Horvitz, Eric TB58
Hoseinzadeh, Mahyar IS-M
Hosking, Michael MC18
Hosseini, Hadi MD24
Hosseini, Vahid WB42
Hotle, Susan MD60
Hou, Tian WD46
Houghton, Peter G. MC03
Housh, Mashor MA40
Houska, Boris WA01
Howley, Robert TA69
Hsiao-Yu, Lin WB55
Hsing, Yu SA73
Hsu, Cheng MC38
Hsu, Hsi-Mei TD14
Hsu, Hsiu-Hao WD43
Hsu, Hsiu-Li WB55
Hsu, Hsun-Wen TD14
Hsu, Po-Hsien MD03
Hsu, Shu-Keng WD43
Hsu, Ya-Ju MD03
Hsu, Yu-Ting TA49
Hsuan, Juliana SC56, MA56
Hu, Guiping MB41, TC40, TD52, WB52
Hu, Huafen MD53
Hu, Jack WD66
Hu, Jian MC10, MC10
Hu, JianQiang TB06
Hu, Leland WC24
Hu, Ming SD35, MC36, MD63, WA17, WC03
Hu, Shanshan MA33, WA36, WB26
Hu, Xianbiao TB47, TD47, WB47
Hu, Xiang MD06
Hu, Xing SA60
Hu, Xinxin WB14
Hu, Yu SD70
Hua, Dingguo SB67, SC05
Huang, Boray WB30, WC64
Huang, Dongling TC71
Huang, Edward WB48
Huang, George Q. WA73
Huang, Jianhua WA67, WD67
Huang, Jing MA44
Huang, Junfei SD58, TD57
Huang, Kuo-Ling TC11, TD22
Huang, Kwei-Long WA39
Huang, Ping MD20
Huang, Pu MA69
Huang, Qiang SA67, TA67
Huang, Rong WC13
Huang, Rongbing MA37, TD37
Huang, Shuai MA66
Huang, Simin SD05
Huang, Terry WC06
Huang, Tingliang TD26
Huang, Wenpo SA01
Huang, Xiao TB26
Huang, Ximin TB32
Huang, Yan MA70
Huang, Yongxi TC40, WD10
Huang, Yufei TA56
Huang, Yuping TA53
Huart, Alexandre TB49
Huchzermeier, Arnd TA39
Huddleston, Jeanne MB19, WA06
Huggins, Annali WB06
Huggins, Eric SB17, TB17
Huggins, Peter WA66
Hughes, Ed TC15
Hughes, Richard TB07
Hughes, Richard TD20
Huh, Tim MC55, TA24, TA29, TD35
Huisman, Kuno MC25
Hult, Henrik TD59
Humair, Salal MC23
Hung, Hui-Chih TD14, WB30
Hung, Ying MD05
Hungerländer, Philipp TA13
Hunt, David MD43
Hunt, Kelly WB45
Hunter, Kevin SA40
Hunter, Susan MD06
Hunting, Marcel SD72
Huo, Xiaoming MC69
Huo, Yumei MA14, WA14
Hur, Minhoe TD66
Hurink, Johann WD42
Hurtado, Margarita SA73
Hurvich, Cliff MC44
Huschka, Todd MB19, WA06
Hussein, Mazen SB01
Hutchison-Krupat, Jeremy SA34, TA34
Hutson, Kevin TB01
Hutton, David TB08, TC19
Hwang, Feng-Jang TD14
Hwang, Taesung MD48
Hwang, Woonam SB03, WA26
Hwarng, Brian WC39
Hyndman, Kyle MA63

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Iancu, Dan SB10, SC69, MA69, WA26
Ibanez, Maria TA28
Ibraheem, Wesam TB12
Ibrahim, Ameera MD26
Ibrahim, Rouba SC57, WB57
Ic, Yusuf Tansel TA06
Ichiba, Tomoyuki MD73
Ichoua, Soumia TB46
Icyuz, Ece MA12, TC43
Ierome, Steve TA23
Ifrach, Bar TC54, WB32
Igharo, Theresa SC04
Ii, Shingo WA55
Ilk, Ozlem WB43
Illing, Stefan TC60
Im, Kwanyoung SB56
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Immorlica, Nicole SA70
Inderfurth, Karl MB33, MD33
Infanger, Gerd MD69
Ingolfsson, Armann SC63, TA08, TD29, WB29
Inkaya, Tulin WA62
Inoue, Shigeaki TD19
Ipeirotis, Panagiotis TC70
Iravani, Foaad MC28, MD44
Iravani, Seyed SD03, SD44, TA32
Irohara, Takashi WD72
Irudayaraj, ISF WB63
Isaac, Delfina TA23
Isaac, Shabtai SC49
Isaksson, Olov TD44
Isbell, Charles TB21
Ishfaq, Rafay WD44
Ishiguro, Kazuhiko SA48, IS-M,
Isik, Tugce SA58
Iskin, Ibrahim WA56
Islam, Samsul SD18

Islegen, Ozge MB26, WA28
Ismail, Mohamed TC39
Isotupa, Sapna TD33, WB34
Ito, Mariko ENRE Poster
Ituarte-Villarreal, Carlos SC41
Ivy, Julie IS-M
Ivy, Julie S. MD08, TC17, TC24, TD24, WC45, WD25
Iyengar, Garud SD69, MA69, MC14, MD10, WC53
Iyer, Krishnamurthy MC58, WA58
Iyoob, Ilyas SA72, SB72
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Jabari, Saif WD46
Jablonsky, Josef WB04
Jabr, Wael SA73, SB70
Jacob, Varghese WA71
Jacobides, Michael MA56
Jacobs, Brian MB40
Jacobson, Sheldon SD14, MB57, TA23, TB08, TD22, WD08
Jafari, Mohsen MA41, WC40
Jafari-Shirazi, Ehsan IS-T
Jaffray, David SC13, SC25
Jagabathula, Srikanth TC35, WA35
Jagannathan, Krishna SB57
Jaillet, Patrick MB57, MC11, TC58, TC72
Jaimungal, Sebastian WC69
Jain, Aditya SD29, MC26, TA38, TB28, TB29, WC26
Jain, Apurva TD73
Jain, Ashish SC73
Jain, Kamal SA70
Jain, Manish TB21
Jain, Nitish SC28, MB27, TC32, WA26
Jain, Rahul MA57
Jain, Shailendra WC45
Jain, Shelen MB63, WA17
Jairam, Jennifer WD19
Jakuczun, Wit IS-M
Jalali, Nima MB67
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Jamal, Abul SA73
James, Rachel TD47
Jampani, Jagadish MD43
Jamshidi, Arta WB72
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Jani, Beena SC24
Jannat, Seratun TA06
Jans, R MA48
Jaramillo, Juan WB17
Jaramillo, Paulina SD33
Jardim, Maria Helena MA01
Jardine, Andrew K.S. WD60
Jarrah, Ahmad SB19, WA48, WD48
Jarugumilli, Shrikant SB11, SB29, TC30
Jasin, Stefanus TC35
Jayaraman, Raja SD42, TA44, WC64
Jayaraman, Vaidy MA33
Jayaswal, Sachin SA18
Jaye, Michael TC50
Jedynak, Bruno WC59
Jenni, Karen SB02
Jennings, Mark TA23
Jennings, Otis TB59
Jensson, Pall WD56
Jeon, Hyemin MC12
Jeong, Byungduk MC18
Jeong, In-Jae SD37
Jeong, Myong K (MK) WD66
Jeong, Young Seon SD42, TA44, WC64
Jerath, Kinshuk SA38
Jha, Krishna MC43
Ji, Ran SA68
Ji, Shoufeng SB31, SD44
Ji, Yibo SD06
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Jia, Fan WA30
Jia, Jianmin SC22
Jian, Ryan WB49
Jiang, Albert Xin TA03
Jiang, Bo WC18
Jiang, Hai TD42
Jiang, Hao TB11
Jiang, Hao WC10
Jiang, Hongxun WA14
Jiang, Houyuan WD28
Jiang, Lan SA47, WA48
Jiang, Lei SB67
Jiang, Li MA55, WB63
Jiang, Nan MC42, WA47
Jiang, Quanhong IS-T
Jiang, Ruiwei SA17, TB10
Jiang, Tingting SD03, TA26, WB62
Jiang, Wei SA01, SA05, TD05
Jiang, Xiaoyue SD34, WC22
Jiang, Yabing MA70
Jiang, Yanmin WB63
Jimenez, Jesus TD44
Jin, Hongxia MD66
Jin, Jianyong WD14
Jin, Judy SA05, SB05, TB07, WD66
Jin, Mingzhou TA43
Jin, Peter J. WD46
Jin, Ran SA67
Jin, Shan WD53
Jin, Shengpeng SC66
Jin, Shuangshuang WD52
Jin, Tongdan MC41, MD67, WC66
Jin, Yue SA58, SD33
Jira, Chonnikarn Fern MB33, MC33
Jirapinyo, Pichayut SD62
Jo, Boram WA22
Joglekar, Nitin SC56, SD34, MB30
Johar, Monica SC70
Johari, Ramesh SB54, SC58, MC58, WA58
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John, Richard MA03, MA09, MB03, WB61
Johnson, Alan MD50
Johnson, Andrew MA39, WB42
Johnson, Andrew TB19, TD04, WA04
Johnson, Ellis SA61, TD60
Johnson, Kris WB03
Johnson, M. Eric HAS Poster
Johnson, Matthew MB19
Johnson, Michael TC08, WC55
Johnson, Sharon WC45
Johnson, Travis TD11
Johnson-Hall, Tracy SB44, WB62
Johnston, Erik SB56
Johnston, Robert WC71
Jokivuolle, Esa WA68
Joliveau, Marc TB12
Jonathan, Patrick MD24
Jones, Douglas SA57
Jones, Dylan SA42
Jones, James MB61
Jones, Jonathan MB73
Jones, Joni WA71
Jones, Katherine WC06
Jones, Philip SD48, WA33
Jones, Todd SC20
Jones-Farmer, Allison WA05
Jonqua, Julien P.C.B. MB55
Jönsson, P. TC41
Jordan, Brian TC25
Jordan, Michael I WA57
Jordan, Rhonda SA40
Jorge, Diana TA42
Jørgensen, Steffen SC44
Jose, Victor Richmond MB02
Joshi, Sanjay SD32
Joubert, Jaco WC41
Jouini, Oualid WB57
Juan, Angel WC72
Júdice, Pedro WD69
Juditsky, Anatoli TA11
Jula, Payman WD44
Jung, Changmi WC23
Jung, Jongbin MA68
Jung, Kiwook WA22
Jung, Kyung Sung MA14, TB18
Jung, Sungmoon SC05
Junglas, Daniel IS-T

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Kabadayi, Nihan TC73
Kabadurmus, Ozgur SA23
Kabiri, Mina WA06, WA24
Kabirian, Alireza SB18
Kabul, Mustafa Onur WC28
Kachani, Soulaymane MD69
Kajikawa, Yuya SA21, SB56, SC14
Kalagnanam, Jayant SD01
Kalashnikov, Vyacheslav IS-T
Kalashnykova, Nataliya IS-T
Kalaykiran, Kemal IS-T
Kalczynski, Pawel SD41
Kalinowski, Thomas WD21
Kalkanci, Basak MB26, MC63, TA36
Kallio, Markku MC09
Kallrath, Josef WC43
Kamarthi, Sagar WB24, WD67
Kaminski, Bogumil IS-M
Kaminsky, Phil WB26
Kamisli Öztürk, Zehra WC09
Kammerdiner, Alla MA11, WB64
Kampa, Kittipat "Bot" SC01, TC07
Kan, Xi WA51
Kanade, Varun TD12
Kanamori, Takafumi MB07
Kanat, Irfan SC39
Kandemir, Cansu WC09
Kang, Bomi SA21
Kang, Chulmin MB69, TA57
Kang, Dong Hun "Don" TC23
Kang, Jamie SD37
Kang, Jihoon TC66
Kang, Keumseok MA71, MB71
Kang, Kyoungwon WD53
Kang, Lulu WA67, WB05
Kang, Tao WB35
Kang, Wanmo MB69, TA54, TA57, TB06
Kang, Weining SA59, TD57
Kang, Yuncheol IS-M
Kani, Iraj MD69
Kanoria, Yashodhan SB58, MC58
Kantor, Paul TC30
Kao, Anne TA66
Kao, Chiang TB04
Kao, Yi-Hao SB54
Kapcak, Selin SC32
Kaplan, Edward SD14, SD51
Kapur, Kailash WD64
Kapuscinski, Roman SD30, WD27
Karabasoglu, Orkun WB43, WC04
Karademir, Serdar SC01, TB01
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Karaesmen, Fikri WB57
Karaesmen, Itir TB35
Karafa, Jeffery SA48
Karakaya, Elif TD48
Karanfil, Özge WC06
Karaoglan, Ismail IS-T
Kardar, Laleh WA20
Karimi, Elnaz TC19
Karlaftis, Matthew MB48
Karmakar, Sandipan SD55
Karmarkar, Uday SB38, TD27, WC27
Karnik, Viraj MD43, TC43
Karpak, Birsen WB09
Karsu, Ozlem MB09
Karvetski, Christopher MB04
Karwan, Mark MB50, WA34
Kash, Ian MC62, MD58
Kashio, Hiroshi ENRE Poster
Kashio, Hiroshi MB39
Kasina, Saamrat MB53
Kasprzyk, Joseph TC09
Kasyanov, Pavlo TC36
Katai, Ferenc TD15
Katariya Prakash, Abhilasha SB27
Katehakis, Michael SB68, TC35, TC36, WA21
Katlic, Peter L. MB23, TB23
Katlubeck, Louisa SB51
Katok, Elena SC26, MA62, TD63
Kattuman, Paul SB63

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Katz, Dmitriy MA59
Katz, Donald MC61
Kaut, Michal MC53
Kavadias, Stylianos SC34, TA34, TB34, TD34
Kawamoto, Kaoru TD73
Kawata, Keisuke TD73
Kay, Michael SB48
Kayis, Enis WC45
Kazakoff, Heather A. WA15
Kazan, Osman TA14, WB19
Kazari, Hessam ENRE Poster
Kazaz, Burak SC30
Kazemi, Yasaman IS-T
Kazemi, Yasaman TSL Poster
Kazemian, Pooyan HAS Poster
Kazemzadeh, Narges MB41
KC, Diwas SD63, TA28, TB25, TC31
Kean, John SD40
Keck, Steffen SC04
Keeney, Ralph MC03
Kefayati, Mahdi MC42
Kefeli, Ali TC73
Keha, Ahmet WC73
Keisler, Jeff TC08, TD03
Kelic, Angie IS-M
Kelle, Peter MD33
Keller, Chris SD35, WB03
Keller, Robin SA03, MD02, TC45
Kellerer, Hans MA14, MD14
Kelley, Scott MB37
Kelley, Tanya SB56
Kemahlioglu Ziya, Eda SB26, MD32
Kempe, David TC61
Kempf, Karl SB23, SC04, WA62, WD57
Keng, Naiping SB29
Kennedy, Deanna SA14
Kennedy, Emily WB66
Kenney, Melissa A. SB03
Kennington, Jeff WD73
Kent, Tim TB20
Keppo, Jussi WA21, WA68, WD69
Kercher, Angela TD29
Kerivin, Hervé TA09
Kerl, Paul WA08
Kerner, Yoav WC31
Kesavan, Saravanan SC38, MB27, MD46, TC31
Keskin, Burcu HASPoster
Keskin, Burcu SB19, SB49, SC19, SD50, WC48
Keskin, N. Bora MD57, TA36
Keskinocak, Pinar SC16, SC49, SD26, MB24, MD49, TC63
Keskinturk, Timur TC73, WB30, WD14
Kessler, John SC27
Kessler, Judd MA63
Ketsche, Patricia WB70
Ketter, Wolf TB71, TD62
Kettunen, Janne TD03, WC44
Key, Peter MD58
Keyhani, Mohammad SC56
Khademi, Amin WA24
Khadgi, Prajwal TA06, WD40
Khajavirad, Aida MB01, MD01
Khaji, Erfan IS-M
Khaled, Abdullah Al TA43
Khaleghi, Amirreza M. SD67
Khan, Ilyas MB39
Khanh Nguyen, Phuong TB49
Khani, Alireza SD49
Khanjari, Neda SD44
Kharbeche, Mohamed SB61, WC60
Kharoufeh, Jeffrey TC59, WB67, WD51
Khawam, John WC55, WD32
Khazaei, Javad SC40
Khazeni, Nayer TC19
Khodadadegan, Yasaman HAS Poster
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Khojandi, Anahita WD25
Khoo, Benjamin WD71
Khosrojerdi, Amirhossein TA52
Khouja, Moutaz SA44
Khowala, Ketan WC73
Khumawala, Basheer SD44
Kian, Ramez TSL Poster
Kianfar, Kiavash MA12, MB12
Kiassat, Corey SB63
Kibar, Ayse Nur SB49
Kiekintveld, Christopher TC61
Kiesling, Elmar MA18
Kilgour, Marc SB17
Kilinc, Mehmet Serdar WA25
Kilinc, Mustafa SB12, SB13, MD01
Kilinc-Karzan, Fatma TA11
Killaly, Bradley TA26
Kim, Bo Kyung TC56
Kim, Bohyun SA44
Kim, Bumsoo TA07
Kim, Byung-In MB48, WB13
Kim, David MB47
Kim, Deok-Soo MC18
Kim, DJ MC14
Kim, Geon-Ha TA54
Kim, Hongseon MA68
Kim, Hyun-Jin SA34, SB39, MC05, MC39
Kim, Jae-Hwan SA01
Kim, Jay MC20
Kim, Jeonghun TD66
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Kim, Jinbeom TC68
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Kim, Jisun WA56
Kim, Jiwon SA47, MA49
Kim, Jong-Geun MB37
Kim, Kibaek SD29
Kim, Kwangho TA46, TA46
Kim, Kwang-Jae SA34, SB39, SD39, MC05, MC39
Kim, Kyoung-Kuk MB30, TA54, TB06
Kim, Kyoungmin WC62
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Kim, Michael TD68
Kim, Michael Jong MB35
Kim, Min Jun SA34, MC39
Kim, Minkyung WD33
Kim, Minsu WC62
Kim, Moon-kyung WD38
Kim, Myung Kyo MB40, TD44
Kim, S. Phil MD33
Kim, Sang Won MD46, SB62
Kim, Sang-Hyun MA26, WA26, WC27
Kim, Seokjin MA37
Kim, Seong Dae TC69
Kim, Seongjoon WC62
Kim, Seongmoon MA68
Kim, Seoung Bum SB66, TC66, TD66
Kim, Seung Hwan TA38
Kim, Seungbeom WA63
Kim, Sojung SC42, TD06
Kim, Song-Hee MD29, WB57
Kim, Suhwan MD21
Kim, Sujin SD06, MA06
Kim, Sukgon WC30
Kim, Sung-Pil SA50
Kim, Sunkyo SB57
Kim, Tae Hyung WD66
Kim, Taehun WB13
Kim, WooChang WD68
Kim, Yong Hoon MC47, WB47
Kim, Youn Sung TA54
Kim, Young Jae SA21
Kim, Young L. WC23
Kimbrough, Steven SA04, MA23
Kimura, Shinnosuke ENRE Poster
Kimura, Shinnosuke MB39
King, Alan SD73, MB10
King, Douglas TA23, WD08
King, Greg SB39, WB25
King, Marvin MB51
King, Russell E. MC31, TB33, WA33
Kipersztok, Oscar TA66
Kirac, Emre SD19
Kirchain, Randolph MC40, WA22
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Kirilenko, Andrei WB60
Kirkizlar, Eser SA59
Kirkizoglu, Isil SA18
Kirkizoglu, Zeynep IS-T
Kirschenmann, Thomas MB18
Kirshner, Sam SC17
Kirson, Antonio TA61
Kitahara, Tomonari MD13
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Kjell, Douglas P. MC03
Klabjan, Diego SD67, TA45, TC52, WB72, WD12
Klampfl, Erica SD33, TA23, TC52
Klassen, Ken MD24
Klastorin, Ted TC14
Klaus, Christian WD22
Kleber, Rainer MD33
Klee, George WB06
Klein, Cerry SA41
Kleinberg, Robert WD35
Kleindorfer, Paul R. SB33, WB34
Kleinmuntz, Don SC02, MC02
Kleniati, Polyxeni-M WA01
Klenk, Jonathan WC51
Kleywegt, Anton SC68, TD36
Klibi, Walid TB46
Klingenberg, Warse WD05
Kloeber, Jack SC02
Klosterhalfen, Steffen WC43
Klotz, Ed TB22, TD15, WA41
Knapp, Ashlee WA38
Knight, Vincent WA29
Knopp, Jeremy WB67
Ko, Hong Seung WC33
Ko, Jeonghan SC32, MA32
Kobayashi, Hiroki WA42
Koberstein, Achim MA48
Koc, Ali SA13
Koc, Utku WD44
Koca, Esra TB73
Kocabiyikoglu, Ayse SA63
Kocaga, Yasar Levent WB31
Kocaman, Ayse Selin MC55
Koch, Thorsten SB22, SD72, TC18
Kochenberger, Gary MA21
Koeleman, Paulien WC58
Koenig, Sven TA42
Koeppe, Matthias SD22
Kogan, Alexander MA10
Koh, Inyoung SB56
Koh, Sanghyeon WA22
Kohn, Wolf MB01
Köksal, Gülser MA17, MB09, WB43
Köksalan, Murat SA16, MB09, MC09, MD45
Koksalan, Murat SB09, MA17, TD09
Kokshagina, Olga SB14, WC56
Kolfal, Bora SC63, WB29
Kollat, Joshua TC09
Kolomvos, George SC11
Komanduri, Ranga TB66
Kommer, Geert-Jan WB29
Konak, Abdulah SA23, TB48
Kondo, Akira MA61
Kong, Guangwen TD27, WC27
Kong, Joohoe MB19
Kong, Nan TB24, TD08, WA48
Kong, Qingxia TC29
Kong, Zhenyu (James) TB05, TB66, TD67
Konukoglu, Ender SA25
Konur, Dincer SB42, WB30
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TSL Poster - Monday (4:30-6:00)

Mayorga, Maria SC32, SD03, TA08, WB29, WB45
Mazieres, Denis TB69
Mazonowicz, Rex SD02
Mazzuchi, Thomas MB67
McCabe, Mike WC23
McCardle, Kevin TA02
McClosky, Benjamin SD21
McComb, Sara SA14
McCowen, Erin TD41
McCreesh, Patrick TD23
McDill, Marc MD41
McDill, Marc MD41, TA41
McDonald, Mary MC51
McFayden, Colin MD41
McGee, Ryan TA23, TC52
McGinnis, Leon SC57, MA67, TB48
McGowan, Michael SB50
McGregor, Carolyn WC23
McGurer, Melinda MC17
McKay, Robyn TC45
McKenna, John TD38
McKinney, Erin IS-M
McKinstry, Craig WD52
Mclaren, Susan WB70
McLay, Laura SD03, MB29, TA08, TB03, TB45, TC45, TD29, WB29
McLeavey, Janet MC17
McMahon, Anne WB09
Mears, Laine SC32
Mecher, Carter WC06
Medaglia, Andrés L. SC14, TA50, TD21, WC49, WC72
Medal, Hugh MB08, MD21
Medina-Borja, Alexandra MA18
Medury, Aditya MA42
Meeker, William WD66
Megahed, Aly TD48
Megahed, Fadel SC72, TA05, TC67
Mehravaran, Yasaman WB73
Mehrotra, Mili MA40
Mehrotra, Sanjay SD29, MB07, MC10, MC20, TA25, TC11, TD22
Mehrotra, Vijay SD23, MD17, WB31
Meijer, Leilani WC41
Meimand, Amir TD49, WB49
Meiren, Thomas SB38, MB39
Meisel, Stephan WA72
Meissner, Joern WA35
Mejia Sanchez, Luis WC62
Mejia, Jorge WA71
Mejía, Mauricio TA50
Meketon, Marc TD43
Melachrinoudis, Emanuel SB18, WA30
Melkote, Shreyes N. SC67
Meller, Russell SC45
Melnyk, Steven WC44
Melouk, Sharif HAS Poster
Melouk, Sharif SB49, SC19, SD50, MC14
Melson, Christopher TA47
Meltzer, David WC19
Memisoglu, Gokhan MB41
Men, Chunhua SC25
Mena, Rodrigo SA41, MC41
Mendelson, Haim SC28
Mendes, André WA73
Mendez, Elizabeth MA66
Mendias, Christopher TD20
Mendoza, Alvaro MB44
Mendoza, Rafael MC73, MC73, WC69
Menezes, Mozart SA20, SC37, MA37, MB24, TD37
Meng, Chao MA18, MD04, WB07
Meng, Lingyun SC60, MB43
Meng, Xiangqian WB60
Meng, Xiaoqiao WC38
Meng, Ying TB14
Meng, Yinhan MD35
Menich, Ronald SB23, SC36
Menietti, Michael TC34
Mennicken, Roman MC20, TB29
Menon, Dinesh MC62
Menze, Bjoern SA25
Merrick, James SC40
Merrick, Jason MD02, TB03, TD61
Mersereau, Adam SC38, TB27, TB33
Mes, Martijn WA34
Mesa-Arango, Rodrigo SD48, MA48, MB48, TA49
Metzler, Adam MD68
Meyer, Garrett MA23, TA03
Meyer, Marlize WB41, WD41
Meyer, Robert R. MA13, WB20
Meyn, Sean TD53, WD53
Miao, Zhuqi TC01
Michalek, Jeremy SD33, WB43, WC04
Michalka, Alex TD13
Michlin, Yefim Haim MA38, MB38
Michor, Franziska SD03
Mico-Umutesi, Delphine SD11
Midthun, Kjetil MC53
Miettinen, Kaisa WD09
Mihic, Kresimir MB36
Mihm, Jurgen MC34, TA56, TB34
Milburn, Ashlea Bennett SB19, SD19
Miller, Bruce TB07, TD20
Miller, David MD18
Miller, Ezra WB21
Miller, George TB19
Miller, Janis WB44
Miller-Hooks, Elise SA49, SB49, SC49, SC61
Millhiser, William SC29, WB14
Mills, Alex SC08, TD29, WC58
Milner, Joseph WA58
Miltenberger, Matthias TC18
Min, K. Jo SA20, WC46
Min, Yong Taek MC20
Minca, Andreea WB60
Miner, Anne SA46
Mineroff, Josh SB41
Minner, Stefan SB30, SB40, SB44, TD21, WB33
Mintz, Yonatan TB55
Miralinaghi, Mohammad WC48
Miralinaghi, Seyed Mohammad WB42
Miranda, Horacio SB39
Mirchandani, Pitu IS-M, SA48, SA49, SB18, SB21, SD37, MD47, WB19, WD47
Mirchandani, Prakash TA35, WC35
Mirghorbani, Mohammad SB22
Mirhosseini, Niloufar Sadat WC40
Mirrokni, Vahab WD35
Mirzaei, Fouad H. MD35
Mirzaei, Shokoufeh WD43
Mirzeabasov, Oleg WA09
Misener, Ruth TA01
Mishra, Abhay WB70
Mishra, Anant SA71, TC34, TD56
Mishra, Nishant MA35, WB63
Mishra, Sabyasachee TC48
Mistree, Farrokh TA52
Mital, Pratik WB48
Mitchell, Daniel MD59, TA73, TB57, WC69
Mitchell, Gary TC14
Mitchell, John TA13, WC18
Mitchell, Michael IS-M
Mitchell, Ross WC24
Mitra, Amit TC05
Mitra, Arijit WB63
Mitra, Subhro SB42
Mitri, Michel MD17
Mittelmann, Hans SA41, TC18
Mittenthal, John MC14, IS-T
Miyagawa, Masashi WA30
Mizuno, Shinji MD13
Mlinar, Tanja WA14
Mo, Jiahui WA70
Moallemi, Ciamac SA06, SB73, MA69, MB69, TA36, WA58
Moarefdoost, Mohammadmohsen MC52
Moazeni, Somayeh TD72, WA53
Mobasher, Azadeh SD12
Mobini, Mahdi TB41
Mobius, Markus SB59
Mockus, Linas SA57
Modai, Alon WD57
Modaresi, Sina SB12, SB13, MD01
Modi, Vijay MC55
Modiano, Eytan SD59
Moe, Wendy TA70
Moghaddam, Kamran SB01
Moguerza, Javier M. MC53
Mohammad, Hussain WB44
Mohan Lal, Tarun MB19
Mohan, Srimathy WB25
Mohapatra, Arupa SC22, WC53
Mohr, Shirley WB15
Mohseni, Ensieh IS-M
Mohseninejad, Leyla MC25
Mohtashami, Sima TC41
Mojsilovic, Aleksandra WB38
Mokashi, Anup SB06
Mokhlesi, Reza WB37
Molavi, Pooya TD70
Molderink, Albert WD42
Molinaro, Marco SB12, SC58
Mollanejad, Mostafa WB49, WC42
Möller, Desdemona MC20
Momcilovic, Petar SA59, SC01
Mondini, Giulio SD09
Mongeau, Scott TC23
Monplaisir, Leslie SA34, SC34
Montagna, Jorge M. SA41
Montague, Enid TC20
Montanari, Andrea SB58, SD07, MC58
Montgomery, Doug WC05
Montgomery, Jason MD43
Montibeller, Gilberto MB03, TD02
Montiel, Luis WA02, WB72
Mookerjee, Vijay SA55, SC70, MA40
Moolchandani, Kushal A. TC60
Moon, Yongma WD40
Mooney, John TC71
Moore, James SC42, TC49
Moore, Jeff TA18
Moore, Thomas TA20, WC06
Moosa, Sharafali SD32
Moradi, Esmaeel TA21
Moraes, Leonardo A.M. MB55
Morais, Danielle MC04
Morales Mahecha, Ridley Santiago WC61
Morales, Juan SA43
Morales, Juan Miguel ENRE Poster
Morales, Juan Miguel SC52, SD53, TC53
Moran, Diego SB12
Moreno Gonzalez, Othon SB70
Moreno, Eduardo TD54, WD39
Moreno-Garcia, Antonio MD27, TC31, TD31, WB27
Morgan, Shona WD34
Mori, Hiroaki TC05
Mori, Junichiro SA21
Morimitsu, Shirou ENRE Poster
Morita, Hiroshi TB04, TC05
Moritz, Brent TA63, WB27
Morlan, Bruce MB19
Morrice, Douglas SA13, MD06, TB44
Morrill, Thayer MA62
Morris, Craig TA18
Morris, James MA51
Morrison, David TD22
Morrow, William SB41, WA13, WB43
Morsi, Antonio TA01
Morton, Alec SC03
Morton, David SA13, MA57, MD21, WB31, WD48
Moryade, Seksun TB52

Moses, Alan TB51
Moss, Sue WC29
Mostagir, Mohamed SA70, TD70
Mota, Caroline MC04
Mott, Fred SC50
Mount, Tim SA41, MB53, WA52
Mouret, Sylvain SB15
Mousal, Hammouda SB32
Mousavi, Mohammad WC04
Mousavi, Seyedreza SC39
Mousavian, Seyedamirabbas WC13
Mousseau, Vincent MD09, WD03
Movahednejad, Mahyar TB49
Moya, Hiram WD61
Moynihan, Gary TA49
Mu, Enrique SD09
Mu, Liying SA55
Mucherino, Antonio WB01
Mueller, Annika MA63, TC34
Mueller, Marcel SD71
Muggy, Timothy MA08
Muhammad, Yousaf Shad WD56
Mukherjee, Niloy SC32
Mukherjee, Ujjal SB34, HAS Poster
Mukhopadhyay, Samar WC44
Mukhopadhyay, Tridas MA70
Muldoon, Frank WB13, WC12
Mumbower, Stacey MD60
Mun, Kwon Gi SA61
Munns, Jeffrey TD23
Muñoz Abogabir, Juan Carlos IS-T
Munoz, Francisco MB53, WB53
Muñoz, Gonzalo TD54
Murage, Maureen MC55
Murali, Karthik WD56
Murali, Pavan WC52
Muramatsu, Masakazu TB13, TC13
Murat, Alper SA11, MB25, MD19, TB44, WA38, WA62, WD18
Murguia, Erika WC25
Muriel, Ana SC24, MD25
Murillo, Carlos MB53, WA52
Murphy, Colin TC40
Murphy, Frederic SA04, SA20, MA23
Murray, Alan MC37
Murray, Chase TC48
Murthy, Nagesh TD32, WB14
Musal, Rasim TA07
Musch, David MC25
Musdal, Hande WC23
Musselman, Kenneth SC45
Mut, Murat MD13
Muthulingam, Suresh MB27, TA02, TD63
Muthuraman, Kumar SA30, MC69, MD30, MD59, TA73, WC69
Mutlu, Sinem MA17
Myndyuk, Olga SC10
Mytalas, George SC57

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Nacev, Alek SA25
Nachtmann, Heather SC31
Nadar, Emre SA54
Nadarajah, Selvaprabu SD30, WB12
Naebulharam, Raed SD05
Nag, Barin MD33
Nagai, Kazuaki ENRE Poster
Nagaraj, Kalyani IS-T
Nagarajan, Mahesh MC63
Nageshwaraniyer, Sai Srinivas WB07
Nagi, Rakesh MA04, WA37
Nagubandi, Govind TD23
Nagurney, Anna SC31, MA31, MC08, MD36, TA06
Nagurney, Ladimer SC31
Nahas, Nicholas SD23, TD23
Nai, Nong TA61
Naimi, Alireza WB13
Nair, Jayakrishnan SB57, MD58, MD62
Nair, Suresh WB39
Naito, Yuta SC53
Najafi-Asadolahi, Sami MD63, TD35
Nakai, Yohei ENRE Poster
Nakamura, Hiroko SC14, SC60, WA55
Nakashima, Kenichi MB59
Nakata, Kazuhide TB13
Nalca, Arcan WC03
Namazifar, Mahdi MD01
Nanduri, Kanchana SD47
Nanduri, Vishnuteja ENRE Poster
Nanry, William SD02
Naoum-Sawaya, Joe TB68
Narasimhan, Chakravarthi WD33
Narasimhan, Ram MB40, TD44
Narasimhan, Sridhar MC70
Narayanan, Arunchalam SB42, TA63
Narayanan, Sriram MB40
Narisetty, Amar TC22
Narwold, Andrew SB41
Nasiry, Javad SC26, SC30
Nasr, Eman MA57, MD44
Nasrabadi, Ebrahim MA11
Nasrabadi, Nasim MC09
Nasrallah, Walid SB14
Nassar, Mario Solares TB55
Nassiffe, Riad SA22
Nassir, Neema SA49, SC49
Natarajan, Arjun MA38
Natarajan, Hari SA31
Natarajan, Karthik SC68, WC13
Natarajan, Karthik V. SA08
Natarajan, Ramesh SA36, WC52
Nault, Barrie SC71, SD71
Naumova, Mariya SD10
Naumovska, Ivana SB46
Nava, Eric MA49
Naveh, Yehuda TB12, WD57
Nazarian, Ehsan MA32
Nazerzadeh, Hamid SB59
Nazzal, Dima MB44, WC48
Nediak, Mikhail MD28
Nedich, Angelia WB11
Negahban, Sahand MB58
Nehrt, Nathan IS-M
Neill, Daniel WC07
Nelson, Barry SD06
Nelson, Christie IS-M
Nelson, Christie TC30, WD61
Nelson, John D. TA41
Nelson, Karl WA66
Nemati Proon, Sepehr SC19
Nematollahi, Eissa WC44
Nembhard, David SB29
Nembhard, Harriet WA27
Nemet, Gregory SB02
Nemhauser, George SB13, MB12, TD22, WD21
Nemirovski, Arkadi TA11
Nepal, Bimal SB42, WC55
Nesterov, Yurii MB13
Netessine, Serguei SA38, SB28, SC26, SC28, SD28, SD63, MA26, MB27, MD27, TA27, TB31, TC31, TC32, TD28, WD28
Neumann, Dirk SD71
Neves Gouveia, Luis Eduardo SA23
Nevskaya, Yulia MC32
Newell, Elizabeth TA03
Newman, Alexandra MB51, WA41, WB12
Newman, Jeff SA37
Neyshabouri, Saba WD40
Ng, Dorbin Tobun SC55
Ng, Frederick WD37
Ng, Tony WB64
Nguyen Thi, Phuong Khan TD17
Nguyen, Christine SB48
Nguyen, Quang Dang WA69
Nguyen, Thanh MD62
Nguyen, Trang MA01
Ni, Tian MC06
NicCharthaigh, Laoise MD40
Nichifor, Alexandru MB62
Nickel, Stefan MA37, TD37
Nicosia, Gaia MD14
Niculescu, Marius Florin MC70
Nie, Marco TD49
Nie, Xiaofeng SA51, SD51
Niederhoff, Julie MC63, TA63
Nieuwesteeg, Peter MA72, MB15
Nigam, Ashutosh TD50
Niknam, Seyed WB64
Nikolaev, Alexander IS-M
Nikolaev, Alexander MA06, TA23, TB08, WA19
Nikoofal, Mohammad SB30, WD02
Nikoukar, Mohammad TC30
Ning, Jie WA21
Ninh, Anh SD10, MB14, TA44
Nishihara, Michi WB68
Nishinari, Katsuhiro SC60
Nishioka, Gilberto TC12
Nitanda, Atsushi TD73
Nitta, Toshihiro TD73
Niu, Huimin TC42
Niu, Jinzhong SC62
Niu, Shun-Chen TB18
Noble, James SA41
Noecker, Robert MA17
Nogales, Francisco J. SC69, TA69, WC72
Noh, Hyunsoo MD42
Nohadani, Omid MC11, WA20
Noiseux, Marie-Hélène SA69
Noon, Charles MB19
Noonan, Patrick TC17, TD03
Noori, Hamid SB44, MD44
Noparumpa, Tim SC30
Norboge, Nicolas SD60
Nordin, Travis MD29
Norman, Bryan A. TB19, WD25
Norouzi, Amirhosein IS-T
Norouzi, Azadeh IS-M
Norrelund, Anders MB42
North, Jeremy WC49
North, Michael TC06
Northcutt, David TD23
Noseworthy, Tom TC25
Nourazari, Sara TD25
Nourbakhsh, Seyed Hadi ENRE Poster
Nourbakhsh, Seyed Mohammad MB48, TC42
Nouri, Behzad SC73
Novati, David SC17
Novoa, Clara MC41
Novoa, Luis TC39, WD48
Nowak, Maciek SC19
Nowicki, David SB31
Nowlan, Nuket WB17
Nsakanda, Aaron L. SC11
Nsoesie, Elaine IS-T
Ntaimo, Lewis SC60, SC72, SD25, TD41, WA10
Nugent, Rebecca WB56
Nunes, Joao Pedro TA73
Nunez, Hector MD55
Nunez, Manuel SA33
Nurre, Sarah IS-M, WB21
Nykamp, Stefan WD42
Nyquist, Pierre TD59

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Oborn, Eivor SD46
Oddur Jonasson, Jonas TC28
Odegaard, Fredrik MD35, TA35
Oeser, Nadine WA03
Oestreicher-Singer, Gal TB70
Offerman, Theo SD04
Offodile, Felix TB40
Ogasawara, Toshio WA55
Ogden, Joan MC42
Oggioni, Giorgia MC41
Oglesby, Jerry MD17
Oguntebi, Joy SA71
Oh, Hyun-Jung SC24
Oh, Jaelynn SD28
Oh, Joo Hee WD70
Oh, Sechan MA39, WB69
Oh, Sewoong MB58
Oh, Sung Yeol SB68
O'Hair, Allison SC24, TA24
Ohlmann, Jeffrey W. MC48
Ojalehto, Vesa WD09
Okajima, Hiroko WD29
Okamura, Tomohito TD73

O'Kelly, Michael E.J. MA32
Okuhara, Koji TB73
Okwo, Adaora MB41
Okyay, Kaan WA25
Olesen, Ole TA04
Olinick, Eli WB01
Oliva, Rogelio SA29, SC38, SD39
Olivares, Marcelo SD63, MB26, MD29, MD46, TD31
Oliveira, Cleber SC50
Oliveira, Pedro MD34
Olivella, Jordi SB29
Olivetti, Elsa MC40, MC40
Oliviera, Fernando SA20, TD69
Olsen, Allan MB42
Olsen, Tava SC26, SD18, TA26, WA31
Olson, Kenneth MB04
Olson, Rick SB41
O'Malley, Mark MA53
Onal, Hayri SD40, MD55, TD52
O'Neill, Daniel WB40
O'Neill, Richard MA52
Onkal, Dilek TD07
Öörni, Anssi MC09
Oosten, Maarten SA37
Oppen, Johan MB48, TC33, WA72
Oraiopoulos, Nektarios SC34
Orban, Dominique SB13
Orcun, Seza SA57
Ordonez, Fernando SA19, MA23, TA42
Ordoobadi, Sharon WD09
O'Rear, Eric SB41
Oren, Shmuel MC67, WA53
Orlando Gomes, Jose TB61
Orlikowski, Wanda SD46
Orlin, James MA11, MA21, WB63
Ormeci Matoglu, Melda SC11, WB14
Ormeci, Lerzan SA19, TA20, TC19
Orsdemir, Adem SB26
Ortega, Luis SD68
Ortiz, Juan D. TA50
Ortiz-Pena, Hector MB50
Osadchiy, Nikolay MB27, TB63, TC31
Osborn, John TA19
Osei-Bryson, Kweku-Muata WB65
Osorio, Carolina SA47, SB47, SD42, SD47
Oster, Matthew TA13, TC30
Ostrovsky, Michael MB62
Ostrowski, James SA12, MA53, WC22
O'Sullivan, Donal WA41
O'Sullivan, Michael MC22
Otero Leon, Daniel Felipe MD60
Othman, Abe TB62
O'Toole, Jay SA46
Ott, Marion TA62
Ottesen, Stig SB53
Ou, Jihong TB36
Ouazene, Yassine MA32
Ouellet, Julian MC51
Ouyang, Yanfeng SB48, MB48, MC43, MD48, TC37, TC42, TD52, WB52, WC48
Ovando Montantes, Mario A. IS-T
Ovchinnikov, Anton SC33, TB63
Oveis Gharan, Shayan WD35
Owen, Megan WB21
Owens, Douglas WC19
Oza, Shweta MC63
Ozaltin, Osman MC22, TB01, TC24
Ozanne, Elissa WC20
Ozaydin, Ozay SD09
Ozdaglar, Asuman SA70, MA69, TC54, TD70, WA08, WB32
Ozdemir, Rifat Gurcan SC32
Ozelkan, Ertunga C. TC73
Ozen, Asli SC24
Ozener, Orsan SC19, MC49, WB14
Ozer, Ozalp SD27, TD63
Ozkan, Erhun TC59
Ozkan, Gulru SA34, TA63
Ozkaynak, Mustafa MB19, WC45
Ozkul, Ahmet MA44
Ozluk, Ozgur WB23
Ozorio, Luiz MA02
Ozpeynirci, Ozgur WC09
Özsen, Raik TA33
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Paatero, Jukka MB55
Pac, Mehmet Fazil TD26
Pachamanova, Dessislava MD45, TA69
Pachter, Meir SD50
Pacifici, Andrea MD14
Pack, Daniel MA50
Padman, Rema TC20, WB70, WC23
Padmanabhan, Balaji TD71, WC70
Paes Leme, Renato WD35
Pai, Prashant MC68
Paintsil, Elijah TC02
Pakath, Ram MD03
Pal, Ankan SD55
Pal, Avishek WC65
Palacio, Juan D. SC14, TA50
Palak, Gokce TC40
Palermo, Vincenzo SA63
Paleti, Chaitanya WA47
Palley, Asa SD04
Palma, Cristian D. TA41
Palmer, Nathan IS-T
Palocsay, Susan MD17
Pan, Feng TD01, WD04
Pan, Kris Baoqian MA66
Pan, Limeng IS-T, WB37
Pan, Rong WB64, WC62, WD24
Pan, Wenting WA44
Pan, Xiajun Amy SD26, MD26
Panahi, Hadi WB73
Panchamgam, Kiran MB36, TB27
Pancras, Joseph MD71
Pang, Guodong SA59, TD57, TD57
Pang, Jong-Shi TA13, TB47, TC47, TD52, WB11, WD49
Pang, Weichiang WD10
Pang, Youming WA14
Pang, Zhan SD35, MC30, TB36, WB37
Pangburn, Michael MC40, WC03
Panhuijzen, Ivo WB19
Panos, Ryan WD71
Pant, Raghav MA04
Paolo, Falbo SB41
Papadopoulos, Chrissoleon MA32
Papageorgiou, Dimitri SA48, MC50, WB12
Papamichail, K.Nadia WD09
Papanastasiou, Yiangos SD27
Papanicolaou, George MD73
Papavasiliou, Anthony SC40, WA53
Papp, David MC10
Paradi, Joseph TB04
Pardalos, Panos SC01, TC21, TD21, WA07, WB65
Parekh, Ojas MB21, TB21, TD18
Parija, Gyana MA29
Parikh, Dhaivat MB43
Parikh, Neehar TA25
Parikh, Pratik TB24, WA48
Park, Chanhee TC66
Park, Chanwoo TC55, WB13
Park, Chiwoo WA67, WC67
Park, Eric MC29
Park, Gigyoung TD50, WB13
Park, Hyunwoo SB38
Park, Jane SC14
Park, JoonChul MB19
Park, Kun Soo MB30
Park, Kyungchan MA68
Park, SeJoon MB47
Park, Seung-Jae TC27
Park, Seyoun MB19
Park, Sunghyuk WD70
Park, Young Woon WD12
Parker, Chris SC71
Parker, Geoffrey WC22
Parker, Nathan TC40
Parker, Rodney SA30, TA26, TA26, TC27, TD20
Parkes, David SD62
Parlak, Ayse WD51
Parlakturk, Ali SB26, TB26, WC28
Parlier, Greg TD51
Parnell, Gregory MD02, TC03, TD61
Parpaillon, Jean TB12
Parr, Ronald TB21
Parra, Ricardo MB60
Parrilo, Pablo A. TD70
Parsons, Jay WB17
Parsons, Simon SC62
Parvan, Kiavash IS-M
Parvin, Hoda SA08
Pasiliao, Eduardo SC21, TC01
Passonneau, Rebecca TA23
Passos Filho, Joao SA56, WC04, WD11
Pastukhov, Grigory SC21
Pasupathy, Raghu SC06, WC10
Patankar, Jayprakash TC05
Pate-Cornell, Elizabeth MD61
Patel, Jigar WD27
Patel, Jignesh TD43
Patel, Meghna WC45
Pathak, Praveen TD56
Patricio, Pedro SA23
Patterson, Raymond MB71
Patty, Bruce SC43, SD43, MA43, MC45
Paul, Alice TB55
Paul, Brijesh SD55
Pauwels, Laurent SB72
Pavlicek, William WA20, HAS Poster
Pavlikov, Konstantin WB68
Pavlin, Michael SD30, WC03
Pavlov, Valery SC26
Pavur, Robert TC05
Paynabar, Kamran SA05, SB05, SC67, TB07
Paynter, Brad WB21
Payton, Fay Cobb WA45
Paz, Alexander WD46
Paz, Sandro IS-T, TA46, HAS Poster
Pazour, Jennifer SC45, MB44, TD48
Pearce, Bryan SC32
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Peeta, Srinivas, SC47, SD60, MA47, MC47, TA49, WA47, WB47, WD47
Pekec, Sasa MC62
Peker, Aysegul WB04
Pekgun, Pelin SB23, SC36, TC63
Pekny, Joseph F. SD52
Peladeau, Normand WA15
Pelayo, Gerardo TA44
Pelizzari, Cristian SB41
Pelletier, Lori WA19
Peloquin, Adam SB51
Peña, Javier SA68, MB07, MC13, TA11
Pena-Alcaraz, Maite WD04
Penaflor, Cynthia SC46
Pender, Jamol TB59
Peng, Chen SB23
Peng, David WB39
Peng, Dening SB18
Peng, Fan WC48
Peng, Fei SC25
Peng, Hao MD67, SC05
Peng, Jiming SC73, MC01
Peng, Lifang WB71
Peng, Xianhua WC68
Peng, Xiaosong SD39
Peng, Yijie TB06
Penmetsa, Nabita TD39
Penna, Débora D.J. TB53

Perakis, Georgia SA17, SA36, SC27, MB28, MB36, MD32, TA36, TB27, TC58
Percival, Jennifer WC23
Perdikaki, Olga SA29, SC38, MD39
Pereira, Victor SD08
Perera, Sandun C. MB68
Perez, Cinthia WA33
Perez, Daniel SC61
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Shi, Victor WB43
Shi, Wenbo WC46
Shi, Zhenyu (Edwin) MC48
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Shieh, Eric MA23, TA03, TC61
Shier, Douglas WB21
Shih, Helen SA25
Shih, Hsu-Shih MD03
Shim, Sangho SD67
Shimada, Naoki TD73
Shimada, Stephanie L. WC45
Shimada, Tomoaki SA32
Shin, Hayong MB19, MC18, TA54, TB06
Shin, Hyo duk SD44, MC70, WA32, WC28, WD28
Shin, Seungchul SA34
Shinano, Yuji SB22, TC18
Shinde, Amit WD57
Shiner, Brian WC23
Shinick, Tom MA46
Shinozaki, Hidetaka ENRE Poster
Shirinkam, Sara TA19
Shirmohammadi, Nima WA49
Shirmohammadi, Shervin WB17
Shirokikh, Oleg SC21
Shirvani Ghomi, Pooyan WB20
Shirwaiker, Rohan MC16
Shittu, Ekundayo MC52, WC22
Shivendu, Shivendu MA71
Shlakhter, Oleksandr SC37, MC72
Shmoys, David MC19, MD25, WC73
Shnaiderman, Matan SC44, SD31
Shoemaker, Christine MD18
Shojaie, Ali TB07
Shortle, John TB60
Shoval, Shraga SA18
Shrivastava, Abhishek WB54
Shroff, Manav SC23, WA64
Shroff, Ness SD36
Shu, Lei WC44
Shu, Lianjie SA01
Shu, Yan Lee IS-M
Shugan, Steven MA41
Shum, Stephen MA55
Shumsky, Robert MA35
Shunko, Masha WA31
Shwartz, Laura SA35, MA38, MB38
Shwartz, Michael MC20
Shwehdi, M.H. TD30
Shylo, Oleg SC19
Sidauoi, Mouwafac MD17
Siddiqui, Afzal SC53, MC53, MC69
Siddiqui, Sauleh MB52
Siebert, Johannes WD03
Siefen, Kostja WC42
Siemsen, Enno MD34, TA63, WB27
Siirola, John D. MC22, MD18, MD22, TD18
Silberholz, John MB25, SC24
Silva Junior, Ivo SA56, WC04, WD11
Silva, Alvin WC24
Silva, Daniel SC29
Silva, Graça WC56
Silva, Kathryn WA19
Silva-Send, Nilmini SB41
Silvennoinen, Kari MC09
Sim, Melvyn SA17, SD11, MB11, MC11, WD48
Simao, Hugo SD52, TA72, WA53
Simard, Martin TA41
Simchi-Levi, David SA28, MB31, MB33, TA40, TA59, TB40, WB03
Simhon, Eran SA18
Simmons, Daniel SC21
Simon, Ben TC12
Simon, Jay SA03, WB08
Simpson, Timothy TC09
Simsek, A. Serdar SC35, TC36
Singer, David SC29
Singh, Moninder WB38
Singh, Narendra SC34, MD40
Singh, Param MA70
Singh, Satinder TC61, WA46
Singhal, Sharad WC45
Singhal, Vinod TC44, TD17
Singham, Dashi SA03, MC66
Sinha, Amitabh MC27, TA30, WB26
Sinha, Ankur WA09
Sinha, Kingshuk K. SC63
Sinha, Ritwik WA64
Sioshansi, Ramteen SC52, SD33, TD53
Sipahioglu, Aydin WC09
Siphai, Rifat TD25
Sipiläinen, Timo TA04
Sirichakwal, Issariya TC14
Sirignano, Justin MA73, MD73
Sirmon, David G. SB46
Skaf, Mazen SA02
Skandari, M. Reza MB25
Skaro, Anton TA25, WA54
Slepoy, Raisa IS-T
Slikker, Marko TC63
Slotnick, Susan TC39
Slowinski, Roman MD09, WD03
Smead, Kirstin MC50
Smeenk, Ferry TD19
Smeers, Yves SB53
Smelov, Dmitry WA68
Smilowitz, Karen SD03, MC48, MD49, WC32
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Smit, Laurens WA21
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Smith, Bruce SC40
Smith, Christopher MA51
Smith, Honora TB39
Smith, J. Cole SC18, SD12, SD22, MC21, MC50, MD16, MD21, TD01, WB21, WC21, WD21
Smith, Jeffery TB38
Smith, Jessica TA61
Smith, Jim WC59
Smith, Leanne WA29
Smith, Marshall TB51
Smith, Mary TA23
Smith, Robert MD13
Smith, Ryan TC42
Smith, Stephen MC26
Smith, Stephen SD30, TC27
Smith, Steven MD72
Sniekers, Daphne SC08, TC25
Snyder, Angela WB70
Snyder, Larry MB31, MB53
Snyder, Lawrence V. MC52, TA37
Snyders, Louis WC41
So, Mee-chi SB68
So, Rick TB44
Sodomka, Eric TA62, TD62
Sofer, Ariela TB45
Sogin, Samuel L. TB43
Soh, Seung Bum MD31
Soheili, Negar MC13
Sohnen, Julia MC42
Sohoni, Milind SA60, SD61, TA27, TC28, WC26
Sokhansanj, Shahab TB41, TD52
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Soldner, Mallory SD08, MA08
Soll, Jack TB02
Solorio, Carlos WD64
Solveling, Gustaf TD60
Somanchi, Sriram WC07
Somani, Kamalesh SB43, MC43
Somervuori, Outi SB09
Sommer, Svenja TA34
Son, Young-Jun SC42, SD18, SD67, MA18, MD04, TD06, WB07
Sondheimer, Norman TA66
Song, Cen TA03
Song, Dongyoon SC47, MA47
Song, Gang IS-M
Song, Inseong WD33
Song, Irene MD69
Song, Jie WD01
Song, Jing-Sheng SA26, TA30, TD63
Song, Lijie SD24, WA31
Song, Rui MB73
Song, Sanling WD64
Song, Yingda WC68
Song, Yongjia TD10
Song, Young Re WD68
Sonmez, Mumin SB32
Sonuc, Sibel B. WD21
Soofi, Ehsan MB67
Soremekun, Olan TB29
Sörensen, Kenneth SB19
Sorokin, Alexey SC21
Sosa, Manuel MC34, TB34
Sosic, Greys MA26
Sotiropoulos, Michael SB73
Soto, Ciro TA23
Sotomayor, Luz R TC68
Souyris, Sebastian WC35
Souza, Gilvan MA33
Souza, Maurício WB01
Sowers, Richard MB73, MD73, WB60
Sowlati, Taraneh TB41, TD52, WA40
Sox, Charles IS-T, WA39
Soyer, Refik SA11, MB67, TA07
Soylu, Banu TA09
Spanton, Shantih MD43, TD01
Sparks, Gordon SD18
Spear, E.J. MB60
Spetzler, Carl SC02, MC02, WA03
Spetzler, Chris WA03
Spicer, Jessica SB19
Spicer, Patrick SA32, WD66
Spieksma, Flora WA21, WB58
Spieksma, Frits MD23
Spiliopoulos, Konstantinos MD73
Spiliotopoulou, Eirini SD44
Spinler, Stefan WB34, WC55
Squillante, Mark MA29, MA59, WB38, WC38
Sreepathi, Sarat SA40
Sri Bhashyam, Sumitra TD02
Sridhar, Natarajan TC51
Sridharan, V. WB44
Srinivasan, Ajay WC35
Srinivasan, Girish SC23
Srinivasan, Padmini MD07
SriramachandraMurthy, Rajendran SC56
Sriskandarajah, Chelliah MA14, TA14, TB18
Srour, Jordan SB14, WA72
St. John, Dia SC18
St.John, Rachel TB41
Staats, Bradley SD63, MB27, TD31
Stacey, Craig MD39
Stadje, Wolfgang TB16
Stadler, Michael MC53
Stahl, James WD20
Staid, Andrea MB04
Stanfel, Larry E. WA65
Stanton, Matt TD29
Starr, Martin TB46
Starr, Stuart MC51
Stauffer, Jon WC32
Stavrulaki, Euthemia MC40
Stecke, Kathryn SB27, TA14, TB45
Steeger, Greg WC21
Steele, J. Michael TA58
Steeneck, Daniel WD73
Stein, Cliff MC14, MD14
Stein, MD, Joshua SA06, MC25
Steinbart, Paul SC39
Steinberg, Richard MB62, WB63
Stempfhuber, Dirk MD63
Stephens, Mia TA15
Stern, Howard SD09
Stern, Steven SD63
Sternbeck, Michael TA39
Stewart, Theodor WD09
Stibolt, Robert SA02
Sting, Fabian MC34, MD63, TA56
Stockbridge, Rebecca TC10
Stöckl, Sebastian SD71
Stoddard, Greg SA70
Stoikov, Sasha SB73
Stonebraker, Jeffrey TC02
Storer, Robert MA19, TA69

Stoyan, Stephen TD40
Stozhkov, Vladimir TC01
Strack, Philipp TB62
Stramer, Susan MA25
Street, Alexandre SC11
Street, W. Nick MB66, MD07
Streicher, Gerrit WB41
Streltchenko, Olga SD73
Strike, Carol WD19
Strinka, Zohar SA31
Ströhle, Philipp WD40
Stroiney, Steve MC60, TB60
Strong, Ray MA39, WB69
Strusevich, Vitaly MA14
Stuart, Colleen SD34
Stummer, Christian MA18
Sturm, Stephan SD73
Sturtevant, Dan SD34
Su, Che-Lin MA28, MD46, TA25
Su, Ed MD07
Su, Qin SA57, TB44
Su, Xuanming SD28, MD63
Su, Yiqiang SA31
Subraman, Suresh SC23
Subramani, Mani MC71
Subramanian, Dharmashankar SA36, MA69, MB10, MC72
Subramanian, Ravi SC34, MB40, MD40,
Subramanian, Shivaram WA13
Subramanian, Sriram WC35
Subramanyam, Ramanath SA71, MB40
Sudhaakar, Swathi SA04
Sudit, Moises MA04, MB50, WA72
Sue Wing, Ian MC52
Süer, Gursel MA44
Suermondt, Jaap WC45
Sugumaran, Vijayan IS-T
Sullivan, Kelly MC21, MD21
Sullivan, Patrick SC52
Sultana, Rudy MC62
Summerfield, Nichalin SD26
Sun, Andy MB10, TA53
Sun, Bo TB01
Sun, Bofei WD01
Sun, Daewon MC70
Sun, Gengyang MC52
Sun, Haoying TB32
Sun, James TA28
Sun, Junbo WB54
Sun, Lei MA06, WA34
Sun, Linyan SB32
Sun, Peng WA36
Sun, Peng WB03
Sun, Shudong WA73
Sun, Wei MB28, TC58
Sun, Xiaoqing Peter TA43
Sun, Yang MC20
Sun, Zhanbo MB47, MD47
Sun, Zhankun WC58
Sunar, Nur SA58, MB26
Sundaramoorthi, Durai WB07
Sung, Je Sang TC01
Sung, Ji Ye Janet WC64
Sung, Li-yeng SD13
Suppa, Uli WA72
Sural, Haldun SA18, MB09
Surasvadi, Navaporn WB28
Suresh, Santhosh SD30
Susel, Irv MB02
Sussman, Jeremy TA24
Sussman, Joseph SD60
Sutton, Charles WA57
Suyabatmaz, Ali Cetin WC43
Suzuki, Atsuo SD68, WA37
Suzuki, Shinji SC14
Sverchkov, Yuriy WC07
Svoboda, Alva SC40, MA52
Swaminathan, Jayashankar M. SA08, SC38, MD46, TB26, TC31
Swamy, Surya MD55, SD15, WA40
Swann, Julie L. SC16, SC19, MA08
Swarat, Elmar MB48
Swaroop, Prem MC61
Sweda, Timothy TC52
Swersey, Arthur TD20
Swinney, Robert SB28, SD28, WA26
Switzer, Fred SA34
Sycara, Katia TD58
Syed, Mujahid WA07
Sylajakumari, Prasanth SC34
Sylvester, Dr. Karl WC45
Szablowski, Evan TB50
Szidarovszky, Ferenc SD67
Szmerekovsky, Ph.D., Joseph TD07
Szwed, Paul SD17

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Taaffe, Kevin IS-T
Tabacca, Jessica MC50
Taboada, Heidi SC41, WD18, WD61
Tadayon, Bita MC21
Taeube, Florian MC46
Tafti, Ali SA71, MB70
Taghavi, Ali MD39
Tahbaz-Salehi, Alireza MA69, TD70
Taheri, Nicole TC52
Tajer, Ali MA41
Tak, Sehyun TA46
Takac, Martin MB13
Takahashi, Paul Y. WC23
Takano, Yuichi TD68
Takashima, Ryuta SC53, SC53, WD68
Takata, Kenta SC18
Takeda, Akiko MB07, TD68
Takemasa, Atsushi IS-M
Talebi, Sahar MB39
Talebpour, Alireza MC47
Talluri, Kalyan MC35
Tambe, Milind MA03, MA23, TA03, TB21, TC61
Tan, Adrian SB44
Tan, Baris TA30
Tan, Burcu WC22
Tan, Fangyun SC26
Tan, Jian WC38
Tan, Jingzi TC08
Tan, Kian Ming SA69
Tan, Matthias SA57
Tan, Tarkan SC33, WA28
Tan, Tom TA27
Tan, Yang SB11
Tan, Yinliang (Ricky) WC33, WD28
Tan, Yong MA70, MC71, MD70, TA62, TC70, WA70
Tan, Yue SA72
Tanabe, Takahito TD73
Tanaka, Ken-ichi WC30
Tanaka, Mirai TB13
Tancrez, Jean-Sébastien WA62
Tandon, Prateek WA66
Tandon, Rohit SC23
Tandon, Vivek TC56
Taneri, Niyazi SC34
Tang, Christopher SA31, SA55, TA02, TB24, TB36, WA39
Tang, Ling WA68
Tang, Linglang WA44
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Tang, Pingzhong SC62, MB62
Tang, Qian SD70
Tang, Shikai IS-M
Tang, Shikai WB42
Tang, Shoupeng WA47
Tang, Victor MA56
Tang, Wenjie SC04
Tang, Yen TD01
Tannous, George TB20
Tanrisever, Fehmi SA13, SD56, MB30, MC30, TB30, WA69
Tansitpong, Praowpan WA55
Tao, Zhi TB40
Tao, Zhijie WA32
Tarakci, Hakan SD32
Taraszewski, Steve WB09
Tarhini, Hussein SB35
Tarun, Prashant SC07
Tarvin, D.A. Tony WB12
Tas, Duygu SC48
Tas, Sinan WC61
Taslimi, Masoumeh SC49
Tatman, Joe TA61
Tawarmalani, Mohit MA01, MD01, WA01
Taylor, Gaylon Don TD30
Taylor, Jeffrey MD47
Taylor, Terry TC26, WA28
Tayur, Sridhar HAS Poster
Tayur, Sridhar MA17, MB06, MC28, MD08, TB24, TC32
Tchung-Ming, Stephane TB52
Teh, Pei-Lee WA71
Tejada, Jeremy IS-T
Tekin, Eylem SB27
Teksan, Zehra Melis WD12
Telang, Rahul MB70
Temiyasathit, Chivalai TC66
Templeton, Alistair MC23
Teng, Yu TD08
Teo, Chung Piaw SC68, TC29, WB46, WC13
Teo, Kwong Meng SC18
Tereyagoglu, Necati SC35, TB63, WA36
Terlaky, Tamás SB13, SC10, MC13, MD13
Terui, Nobuhiko WD33
Terwiesch, Christian SD63, TA28, TB29, TD31
Teter, Mike TC03
Tetzloff, Isaac TC60
Teunter, Ruud WD05, WD34
Teytelman, Anna SA24
Tezcan, Tolga MA58
Thai, My WC01
Thakar, Charuhas TB24
Thakur, Deepika SB55
Thakur, Lakshman WB39
Thakur, Pooja SB38
Thatcher, Matt MC34
Thereska, Eno SD36
Thiele, Aurelie SB35, TA10
Thomas, Barrett W. SC48, SD48, MC48
Thomas, Bex G. SD18, MB23, TB23
Thomas, Doug TD33
Thomas, Marlin MA16
Thomas, Robert SA41, SC01, MB53, WA52
Thomas, Valerie SD37, WA08
Thomé, Fernanda SA53, SB40
Thomé, Luiz Mauricio SA53, WA53
Thompson, Amy TD30
Thompson, David SC62
Thonemann, Ulrich SA63, MA63, TA33, TC33, TC63
Thorleuchter, Dirk WA64
Thornburg, Eric TB50
Thorsen, Andreas SD11
thottakkara, paul WB65
Thottethodi, Mithuna SD36
Thulasiraman, Krishnaiyan SA23
Thurston, David MA43
Tian, Fang MA26
Tian, Ye WB47
Tian, Zhigang SC05, MD67, WC66
Tian, Zhili MD34, WC56
Tiemessen, Harold MB06
Tignor, Ashlin TD53
Tilson, Vera WD37
Timkovsky, Vadim WB68
Tinga, Tiedo WD05
Titman, Sheridan WA69
Tivnan, Brian MA07
Tiwari, Santosh WA09
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Tiwary, Hans Raj SD12
Tizik, Alexander IS-T
To, Thanh TB01
Tokgoz, Emre TC11, WC11
Toktay, Beril SA30, SC33, SD45, MA26, MA33, MD32, MD54, TB32, WA32
Toledano, David S. MB23, TB23
Tomasgard, Asgeir SB53
Tomlin, Brian MC23, WC27
Tomlin, John TA22
Tompaidis, Stathis MC69, TB57, TB57, WA69
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Tongprasit, Waraporn SB73
Topaloglu, Huseyin MC35, MD28, TC29, TC35, WA29, WA35
Topcu, Ilker SD09
Toptal, Aysegul WD44
Torabi, Elham MA24
Torabi, S.A. TC11
Toriello, Alejandro SB48, SC12, SC12, TB08, TC46
Torigoe, Norio MA45
Toro-Diaz, Hector TA08, WB45
Toth, Paolo WD14
Toth, Sandor SD40, TA41, TB41
Tou, Weng Hei WD72
Toulouse, Michel TB49
Toumazis, Iakovos MD49
Tounsi, Lamia WB02
Toyasaki, Fuminori MB08
Trafalis, Theodore SD11, WC30, WD65
Tran, Hoang MC07
Tran, Trung Hieu SC18
Transchel, Sandra SB44, MA35, MB33
Trapp, Andrew MB01, TC07
Trevino, Gerardo WC25
Triantis, Kostas TD04, WA04
Trichakis, Nikos SB10, SC69
Trick, Michael MB29
Tripathi, Arvind TA62
Tripsas, Mary SA46
Troncoso, Juan Jose MD41
Trovo, Daniel G. E. MD55
Trukhanov, Svyatoslav SD21
Truong, Huy TD30
Truong, Nguyen SB63
Truong, Van-Anh TA29
Tryster, Chavatzelet MB05
Tsadiras, Athanasios MA32
Tsai, Hsin-Tien WD43
Tsai, Jason TB21
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Tsai, Yu-jiun (June) IS-M
Tsai, Yu-jiun (June) MB37
Tsalatsanis, Athanasios TD20
Tsanko, Elena TB12
Tsay, Jason SD34
Tse, David SB58
Tseng, Chung-Li WB25
Tseng, Tzu-Liang WB35
Tsetlin, Ilia WB03
Tsitsiklis, John N. SB25, SC57, SD59, TC54
Tsui, Kwok SA01, MA66
Tsujimura, Motoh TD40
Tsung, Fugee SA05, TD05
Tsurkov, Vladimir IS-T
Tsuzaki, Kenji TD73
Tsyurmasto, Peter WB68
Tu, Wanzhu TD08
Tubertini, Paolo WA25
Tucci, Gabriel SD33, MC53
Tucker, Anita SC63, SD24, MC20, MC24, TA28
Tulabandhula, Theja SA07
Tulu, Bengisu WC45
Tunasar, Cenk TD23
Tunca, Tunay SB62
Tuncel, Levent TC13
Tung, Alex TB71
Turcic, Danko MA30
Turcotte, David TC08
Turgut, Ozgu WD18
Turkcan, Ayten SD25
Turner, Jonathan SD29
Turner, Liz TD38
Tuunanen, Tuure SA39
Tuv, Eugene SD66
Tuveson, Michelle TD07
Twomey, Janet SA35
Tyagi, Rajesh SD18, WD42
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Tyldesley, Scott MD29
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Uday, Payuna TD60
Uddin, Ghulam WD67
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Ueno, Nobuyuki TB73
Ugray, Zsolt WA71
Ugur, Bahri Berker IS-T
Uhan, Nelson TC46
Uichanco, Joline SC27, MB28
Ukai, Takamori TD19
Ukkusuri, Satish SB47, SD47, SD48, MA47, MB48, MD49, TA47, TA49, TB47, WA47
Ulku, M. Ali TA38
Ulku, Sezer MC32
Ullrich, Carl SC53, TB69
Ullrich, Christophe WA06
Ulrich, Karl TB34, TC34
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Umyarov, Akhmed SB71
Underwood, Daniel MA25
Ungar, Lyle MB58
Unkelbach, Jan SA25, SB25, WA20
Unlu, Yasin TA33
Unnikrishnan, Avinash TD47
Unver, Utku TC24, TD24
Upatising, Benjavan WC23
Uppal, Raman TA69
Uppari, Bhavani Shanker SB17
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Uster, Halit SB49, MB41, TA45
U-tapao, Chalida MB52
Utsunomiya, Shoko SC18
Utterback, James MD56
Uygur, Alper MA22
Uysal, Pinar TD44
Uzsoy, Reha MB16, IS-M, IS-T
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Vakhutinsky, Andrew MB36, TB27
Valenti, Benedetto WB14
Valenzuela, Jorge WC13
Valero, Jorge SD02
Valladão, Davi SC11
Valogianni, Konstantina TB71
van Buuren, Martin WA29, WB29
van de Ven, Peter SB58
van den Berg, Pieter WA29
Van den Bergh, Jorne TC73, WD60
Van den Broeck, Jan TC28
Van den Poel, Dirk SC48, WA64, WC65
Van den Schrieck, Jean-Christophe SC57
van der Gaast, Jelmer SD57, TB48
van der Heide, Gerlach WD04
van der Mei, Rob WA29, WB29
van der Vliet, Kasper TD17
Van der Westhuizen, Nicaleen WB41
van Dorp, Johan MB67
van Heck, Eric TD62
Van Hentenryck, Pascal TB12, TC12
van Hoeve, Willem-Jan MB21, MD08, TC12
van Houtum, Geert-Jan SC05, SC33, MB06, MD67, TD33, WD05
Van Itallie, Elizabeth SB08
van Jaarsveld, Willem MB06
van Lint, Hans SD16
Van Mieghem, Jan SA26
Van Nieuwenhuyse, Inneke MD33
van Nieuwkoop, Renger MB72
van Oosterom, C.D MD67, WD05
Van Oyen, Mark HAS Poster
Van Oyen, Mark SA06, SA08, SC29, MC24, MC25, MC29, WC29
Van Roy, Benjamin SB54, SB73, SC58, TC72
Van Ryzin, Garrett SB34, SC35, MA28, TC36
Van Sistine, James SB23
Van Utterbeeck, Filip WA06
Van Vyve, Mathieu SB21, WB40, WD13
Van Wassenhove, Luk MA08, MB44, MC08,TB32, WC32
van Wijk, Alexandra TD33
van Woensel, Tom SC48, MC49, TA48
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van Zuylen, Henk SA42
van Zwieten, Dirk TC59
Vanajakumari, Manoj TA14
Vandaele, Nico TC30
Vande Vate, John SC11
Vanderbeck, Francois TD13
Vanderbei, Robert SC13
Vanderby, Sonia SA29, TC25
VanDeusen, Adam TC02
VanDyke, Carl MA43
Vanli, Arda SA67, SC05
Vannoy, Sandra WC71
Vanteddu, Gangaraju MD44
Vardar, Cem TA18
Vargas, Luis G. MD04, WA19
Varghese, Vijith WA25
Varshney, Kush R. WB38
Varshney, Lav WB02
Vartiainen, Tero SA39
Varzgani, Nilofar SB68
Vasudeva, Gurneeta MD34
Vasudeva, Vivek TA01
Vaze, Vikrant SB60, MC61
Veatch, Mike SD08, TB17
Vecchietti, Aldo SA41
Veeraraghavan, Senthil SC35, MD28, TA31, TB31, TB63, TD26, WB28, WC31, WD31
Veiga Pereira, Mario SA53, SB40, SD01, TB53, WA53
Velarde, Jose WB34
Velazquez, Josue TB40
Veldwijk, Joost MD19
Veloso, Francisco MA56
Vempala, Santosh TD12, WB59
Vengazhiyil, Roshan SC67, WA67, WB05
Vengerov, David MB36
Venkatachalam, Saravanan SB42
Venkataraman, Sriram TA28
Venkataramanan, Munirpallam WB06
Venkatraman, Ravi TD47
Venkatraman, Sriram TA28, WD28
Ventresca, Mario SB24
Veral, Emre WB14
Verbas, Omer I. SD49
Vercamer, Dauwe SC48
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TA49 Joint Session TSL/SPPSN: Evacuation Planning
TA50 Military Manpower Planning Models and Applications
TA51 Tutorial: Managing Spare Parts
TA52 Evaluating the Controllability of a System of Plug-in Hybrid Electric Vehicle Charging Stations
TA53 Advanced Models and Algorithms for Power Grid Design and Operations
TA54 Business Innovation Cases in Korean Firms
TA56 Joint Session TMS/ORG: Managing Product Configuration and Improvement
TA57 Applied Probability and Financial Engineering
TA58 Advances in Stochastic Optimal Control and Learning II
TA59 Optimal Control Policies I
TA60 Airport Capacity Frontier Analysis: Current Methods, Tools and Findings: Part I
TA61 Homeland Security Analytics - I
TA62 Bidding in Auctions
TA63 Decision Making in Operational Contexts
TA66 Data Driven Analytics in Support of Equipment Health Management
TA67 Nanomanufacturing and Nanoinformatics I
TA68 Simulation Techniques in Financial Risk Management
TA69 Optimization in Finance
TA70 Interactive Advertising
TA71 Improving Corporate Information Security through Policy
TA72 Computational Stochastic Optimization in Energy I
TA73 Topics on American Options

Tuesday, 11:00am - 12:30pm

TB01 Nonlinear Integer Optimization and Applications
TB02 Advice Taking and Opinion Aggregation
TB03 Games, Decisions, and Descriptive Models Beyond Rationality
TB04 Data Envelopment Analysis II
TB05 Decision Analysis Approaches and Predictive Modeling to Managing Uncertainty in Manufacturing and Service Systems Design & Operations
TB06 Monte Carlo Methods in Finance
TB07 Data Mining in Medical Decision Making and Bioinformatics Applications
TB08 Joint Session PPSN/HAS: Optimization in Health Policy
TB09 A History of Multiple Criteria Decision Making
TB10 Joint Session OPT/ENRE: Stochastic Programming and Power System Optimization
TB11 Optimization Algorithms
TB12 Joint Session Optimization IP/ICS: Constraint Programming Methodology and Applications I
TB13 Solving Hard Problems in Conic Optimization I
TB14 Practical Batching and Supply Chain Scheduling Problems
TB15 Software Demonstration
TB16 Modeling and Analysis of Perishable Inventory Systems with Random Input
TB17 Joint Session INFORM-ED/CPMS:Teaching OR/MS Related Internships and Independent Studies
TB18 Scheduling and Logistics
TB19 Disease Prevention and Immunization
TB20 Data for Health Care
TB21 Security Games and Optimization on Networks
TB22 Branching in Mixed-Integer Programming I
TB23 Innovation in Analytics Award: Semi-finalist Presentations II
TB24 Analyzing Policy Options
TB25 Healthcare Analytics
TB26 Operational Models of Mergers and Alliances

TB27 Modeling and Learning Demand
TB28 Sourcing Strategies for Retailers and Manufacturers
TB29 Empirical Investigations into Delivery of Healthcare
TB30 Commodity Procurement and Processing
TB31 Innovative Modern Service and Inventory Systems
TB32 Impact of Environmental Policy on the Durable Products Supply Chain
TB33 Inventory Management with Stochastic and Changing Demand
TB34 Emotions and Innovation Management
TB35 New Applications in Revenue Management
TB36 Quality, Pricing, and Channel Decisions
TB37 P-Median and Variants
TB38 Panel Discussion: Teaching Service Science
TB39 Production and Assignment Problems
TB40 Joint Session ENRE/SPPSN: Carbon Abatement Policies
TB41 Forestry Session III
TB42 Urban Mobility and Land Use
TB43 Railway Capacity Analysis
TB44 Supply Chain: Managing Disruptions
TB45 Panel Discussion: Time Management
TB46 Disaster and Emergency Response II
TB47 Dynamic Traffic Assignment II - System Optimal Modeling
TB48 Facility Logistics I
TB49 Planning and Routing in City Logistics
TB50 Modeling and Analyzing Military Operations and Systems I
TB51 Applying Analytics to Support Condition Based Maintenance Decisions
TB52 Modeling Natural Gas Markets with OR Techniques
TB53 Stochastic Hydro-Thermal Scheduling II
TB55 Undergraduate Operations Research Prize I
TB56 Joint Session TMS/NPD: Technology Management Section Best Paper Winner Presentation
TB57 Applications of Stochastic Control to Finance
TB58 Data-driven Decisions: Methods and Applications
TB59 Queues with Abandonments
TB60 Airport Capacity Frontier Analysis: Current Methods, Tools and Findings: Part II
TB61 Risk-Based Decision Making in Emergency Situations
TB62 Auctions and Private Information
TB63 Behavioral Issues in Revenue Management
TB66 Data Mining Applications
TB67 Nanomanufacturing and Nanoinformatics II
TB68 Asset Valuation and Risk Modeling
TB69 Energy Risk
TB70 Social TV and Video
TB71 Energy Information Systems
TB72 Computational Stochastic Optimization in Energy II
TB73 Lot Sizing and Production Planning

Tuesday, 12:30pm - 2:30pm

Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01 Global Optimization in Graphs/Networks
TC02 Joint Session DAS/HAS: Decision Analysis in Public Health
TC03 Joint Session DAS/MAS: Military Decision Analysis
TC04 Data Envelopment Analysis III
TC05 Statistical Monitoring and Detection
TC06 Agent-based Modeling and Simulation – Overview and Tutorial
TC07 Optimization and Prediction in Data Mining
TC08 Community-Based Operations Research
TC09 Evolutionary Multi-Criterion Optimization - II
TC10 Advances in Integer Stochastic Programming and Testing Solution Quality
TC11 Algorithmic Non-linear Optimization
TC12 Joint Session Optimization IP/ICS: Constraint Programming Methodology and Applications II
TC13 Solving Hard Problems in Conic Optimization II
TC14 Current Issues in Complex Projects
TC15 Software Demonstration
TC16 Mining Social Media: A Brief Introduction
TC17 Communication Instruction in Business & Industrial Engineering : Tools & Recommendations for Your Own Setting
TC18 Continuous and Discrete Optimization Software: State-of-the-art
TC19 Disease Transmission
TC20 Information in Health Care
TC21 Disaster and Evacuation Management
TC22 Computational Integer Programming
TC23 Innovation in Analytics Award: Semi-finalist Presentations III
TC24 Game-Theoretic Applications in Healthcare
TC25 Healthcare Modelling
TC26 Operations Economics: Dynamic Models
TC27 Interface of Operations and Finance
TC28 Global Health Operations
TC29 Appointment Sequencing and Scheduling
TC30 Resource Allocation
TC31 Empirical Analysis in Services and Retail
TC32 Strategic Operations and Marketing Decisions in a Supply Chain
TC33 Inventory Management
TC34 Innovation Contests
TC35 Optimization Models in Revenue Management
TC36 Revenue Optimization and Related MDP Methodologies I
TC37 Energy Infrastructure Modeling
TC38 Supply Chain Services: Models and Applications-II
TC39 Topics in Operations Management I
TC40 Joint Session ENRE-Env& Sustainability/Energy: Green Biofuel Supply Chain Management
TC41 Forestry Session IV
TC42 Transit System Modeling
TC43 Unit Train Planning and Scheduling
TC44 Supply Chain, Practice and Empirics: Inventory
TC45 Panel Discussion on Women in Engineering: Publishing
TC46 Game Theory I
TC47 Dynamic Traffic Assignment III - User Equilibrium Modeling in Continuous-Time
TC48 Facility Logistics II
TC49 City Logistics Impact Evaluations
TC50 Modeling and Analyzing Military Operations and Systems II
TC51 Big Data Analytics for Condition Based Maintenance
TC52 Decision Making for Electric Vehicles
TC53 Pricing in Electricity Markets Including Nonconvexities and Stochastic Producers
TC54 Learning in Social Networks
TC55 Undergraduate Operations Research Prize II
TC56 Emerging Themes in Technology Management
TC57 Applied Probability in Energy and Risk Analysis
TC58 Healthcare Operations
TC59 Optimal Control Policies II
TC60 Impacts of Environmental and Quality Programs in the Airline Industry
TC61 Patrolling Problems in Security
TC62 Auctions and the Core
TC63 Joint Session Behavioral Oper/Auctions: Behavioral Mechanism Design
TC66 Joint Session DM/QSR: Novel Classification and Clustering Algorithms for Data Mining
TC67 Fault Management for Complex Engineering Systems
TC68 Financial Engineering & Regulations: From Credit Risk To Energy
TC69 Advances in Risk Analysis
TC70 Search and Social Media
TC71 The Internet-Driven Economy
TC72 Exploration
TC73 Production Planning

Tuesday, 4:30pm – 6:00pm

TD01 Integer Programming and Network Optimization
TD02 Joint Session DA/INFORMS Journals:Special Issue of Decision Analysis on Games and Decisions in Reliability and Risk
TD03 Resource Allocation and Investment Decisions
TD04 Data Envelopment Analysis IV
TD05 Technometrics Invited Session New Directions in Statistical Process Control
TD06 Agent-based Simulation of Complex Adaptive Systems
TD07 Forecasting
TD08 Joint Session PPSN/HAS: Health Care Policy Analysis
TD09 Preference Learning II
TD10 New Models and Algorithms for Discrete Optimization with Uncertainty
TD11 Algorithms for Nonlinear Optimization and Optimal Control
TD12 Algorithmic Learning Theory
TD13 Strong Formulations and Cutting Planes for MIP
TD14 Scheduling Models and Applications
TD15 Software Demonstration
TD16 Particle Filtering
TD17 Operations Management
TD18 New Developments in the PICO/PEBBL Parallel Branch and Bound Solver
TD19 Resource Management in Health Care
TD20 Health Care Treatment and Therapy
TD21 Decomposition Approaches for Solving Network Optimization Problems
TD22 Branching in Mixed-Integer Programming II
TD23 Joint Session Analytics/CPMS: Reprise 2011 Innovation in Analytics Finalists and Award Winner
TD24 Stochastic Models for Medical Decision Making
TD25 New Healthcare
TD26 Customer Queuing Behaviors and Their Implications f or M&SOM
TD27 Topics in Service Management
TD28 Sustainability in Operations Management
TD29 Joint Session MSOM/SPPSN: Emergency Medical Services (EMS) Operations
TD30 Facilities Planning and Design
TD31 Empirical Research in Service Operations
TD32 Supply Chain Risk and Information
TD33 Inventory Allocation and Pooling
TD34 Project Management: Teams, Dynamics and Incentives
TD35 Pricing and Revenue Management: Dynamic Pricing
TD36 Advances in Discrete Consumer Choice Model
TD37 Location Objectives I
TD38 Service Operations Management: Forecasting, Capacity Planning, Scheduling and Performance Optimization
TD39 Topics in Operations Management II
TD40 Joint Session ENRE-Env& Sustainability/Energy: Environmental Energy Models
TD41 Stochastic Programming Models for Wildfire Response Planning
TD42 Transportation Operations
TD43 State-of-the-art Implementation of OR Applications
TD44 Supply Chain, Practice and Empirics
TD45 Joint Session JFIG/INFORM-ED: Maximizing Learning Impact with Web-Based Simulation and Classroom Activities
TD46 Game Theory: Application
TD47 Route Choice and Traffic Assignment
TD48 Facility Logistics III
TD49 Pricing and Financing of Transportation Systems: I
TD50 Telecommunications
TD51 Joint Session: MAS/SPPSN/CPMS/SS: Tutorial: Transforming Military Supply Chains - Management Innovation in DoD
TD52 Joint Session ENRE Energy/Environment & Sustainability: Biomass Energy Market and Supply Chain
TD53 Pricing in Electricity Markets Including Nonconvexities
TD54 Applications in Open Pit Mining
TD56 Joint Session TMS/ORG: Outsourcing of Knowledge-Based Tasks: Challenges, Strategies, Performance, and Implications
TD57 Asymptotic Analysis of Large-Scale Service Systems
TD58 Stochastic Models in Services and Computing
TD59 Quantitative Risk Management
TD60 Airport Runway and Taxiway Scheduling
TD61 Decision and Risk Analysis for Emergency Management and Terrorism Risk
TD62 Agents and Machine Learning Techniques for Auctions
TD63 Behavioral Theory in Operations Management
TD66 Joint Session DM/QSR: Various Applications in Text Mining
TD67 Sensor-based Monitoring, Modeling and Analysis I
TD68 Advances in Financial Engineering
TD69 Applications of Risk Analysis
TD70 Social and Economic Networks
TD71 Personalized Recommender Systems
TD72 Approximation Methods for Stochastic Optimization
TD73 Dynamic Scheduling

Wednesday, 8:00am - 9:30am

WA01 Topics in Global Optimization, and Real-World Applications
WA02 Discrete Decision Analysis Under Uncertainty
WA03 Panel Discussion: Enhancing Adolescents' Lives through Decision-Making Skills
WA04 Data Envelopment Analysis V
WA05 Phase I Control Charting: New Directions and Research Opportunities
WA06 Joint Session SIM/HAS: Healthcare Applications using Simulation
WA07 Joint Session DM/ICS: Integer Programming in Data Mining
WA08 Policy Models
WA09 Handling Many Criteria Decision-making and Optimization Problems
WA10 Computational Methods for Risk-Averse Stochastic Programming
WA11 Algorithms for Nonlinear Optimization
WA12 Joint Session Opt. INT/Minority: Integer Programming Techniques for Matroid Problems
WA13 Integer Programming in Business Settings
WA14 Scheduling and its Integration with Other Operations
WA15 Software Demonstration
WA16 Tutorial - Introduction to the Data Mining Process
WA17 Revenue Management of Differentiated Products under Competition
WA18 Smart Services in Operation: Findings and Conclusions
WA19 Readmisson and Patient Placement
WA20 Optimal Radiation Treatment I
WA21 Revenue Optimization and Related MDP Methodologies II
WA22 Learning
WA24 Healthcare Applications
WA25 Healthcare Applications I
WA26 Managing Disruption Risks in Decentralized Supply Chains
WA28 Sustainable Operations Management
WA29 Emergency Operations
WA30 Advances in Facility Location I
WA31 Operations in Healthcare Applications
WA32 Environmental Issues in Supply Chain Management
WA33 Inventory Management for Perishable or End-of-Life Product
WA34 Transportation and Shipping I
WA35 Algorithms to Solve Practical RM Problems
WA36 Pricing in the Presence of Promotional Effects
WA37 Location Objectives II
WA38 Air Transportation Service Science
WA39 OM-Marketing Interface: Pricing I
WA40 Joint Session ENRE-Env& Sustainability/Energy: Energy and Environment
WA41 Applications in Underground Mining

WA42 Transportation Operations for Express and Transit Vehicles
WA43 Studies on Shared Corridors
WA44 Supply Chain: Applications with Risk Management
WA45 Joint Session MI/HAS: Designing Web and Social Media Experiences to Address Health Disparities
WA46 Game Theory II
WA47 Traffic Assignment and Applications
WA48 Facility Logistics IV
WA49 Congestion Pricing
WA51 Methods Supporting Military Logistics and Testing
WA52 Renewable Electricity Markets and Policies
WA53 Applications of Parallelization and High Performance Computing in Electric Power Systems
WA54 Disease Management
WA55 Aviation Technology and Management
WA56 Technology Management in the Service Sector
WA57 Data Driven Stochastic Service Systems
WA58 Limit Order Book Dynamics and High-frequency Market Microstructure
WA60 Delay Patterns in Aviation Networks
WA61 Homeland Security Analytics - II
WA62 Managing Product Variety
WA63 Behavioral Issues in Procuring Services and Goods
WA64 Applications of Data Mining I
WA65 Theory of Data Mining I
WA66 Data Driven Methods for Assessment of Radiation Threat
WA67 Gaussian Process Modeling for Complex System Control and Forecasting
WA68 Financial Engineering and Applied Probability
WA69 Commodity Operations and Risk Management
WA70 Mobile and Crowd Market
WA71 Social Network and Online Advertising
WA72 Vehicle Routing Problems with Uncertainty or Dynamic Elements
WA73 Scheduling in Jobs Shops and with Synchronization

Wednesday, 11:00am - 12:30pm

WB01 Heuristics for Global Optimization, and Real-World Applications
WB02 Data-driven Decision Analysis
WB03 Topics in Decisions Analysis
WB04 Theory and Application of Data Envelopment Analysis
WB05 Computer Experiments
WB06 Joint Session SIM/HAS: Modeling and Simulation of Healthcare Systems
WB07 Data-driven Simulation Modeling
WB08 Joint Session SPPSN/ENRE-Environment: Sustainability Planning
WB09 AHP/ANP for Sustainability
WB11 Equilibrium Problems and Variational Inequalities: Hierarchy
WB12 Covering and Packing in IP: Novel Extensions and Techniques
WB13 Integer Programs with Knapsack and Assignment Problem Connections
WB14 Recent Developments in Scheduling: Theory and Practice
WB15 EZ Website Management Tools and Hosting for INFORMS Communities
WB16 Tutorial Maritime Shipping Logistics
WB17 Interactive Learning
WB18 Optimization Methodologies: Speed and Efficiency
WB19 Medication and Blood Products
WB20 Optimal Radiation Treatment II
WB21 Network Applications I
WB22 Contingency-Constrained Optimization for the Electric Power Grid
WB23 Large Scale Spreadsheet Applications in Business
WB24 Modeling and Analysis of Healthcare Systems
WB25 Healthcare Applications II
Foyer Poster HAS Session
WB26 Capacity Management
WB27 Field Tests, Experiments and Empirical Work in OM
WB28 Customer Behavior and Pricing
WB29 Emergency Services
WB30 Heuristics for Facility Location
WB31 Staffing and Routing in Call Centers
WB32 Advanced Information Economics with Applications to Operations
WB33 Inventory Management in Retail
WB34 Transportation and Shipping II
WB35 Behavioral Model Based Revenue Management
WB36 Supply Chain, Manufacturing and Stochastic Program
WB37 Inventory or Capacity-based Dynamic Pricing
WB38 Workforce Uncertainty and Optimization
WB39 OM-Marketing Interface: Pricing II
WB40 Pricing in Energy
WB41 Business Case Studies in the Petrochemical and Petroleum Industries
WB42 Tranportation Planning
WB43 Design Engineering
WB44 Supply Chain: Concepts for Risk Management
WB45 Joint Session MI/HAS: Modeling and Analysis in Healthcare
WB46 Industry-specific Sustainabiity Issues
WB47 Shortest Path Searching Algorithms and Applications
WB48 Facility Logistics V
WB49 Pricing and Financing of Transportation Systems: II
WB51 Modeling and Simulation for Military Logistics Support
WB52 Biofuel Supply Chain Management and Operational Planning
WB53 Power-systems Transmission and Generation Expansions Under the Presence of Renewable Resources
WB54 Sensor-based Monitoring, Modeling and Analysis II
WB55 Vehicle Routing Problems I
WB56 Determiners of Innovation: Governments, Firms & Individuals
WB57 Data-Based Applications in Call Centers
WB58 Markov Decision Processes and its Applications
WB59 Scaling and Dynamics for Stochastic Systems
WB60 Market Microstructure
WB61 Joint Session: Emerge Mgmt/MAS: Decision Models for Counter-terrorism and Cyber Security
WB62 Outsourcing
WB63 Supply Chain: Applications with Game Theory and Auctions
WB64 Accelerated Life Testing and Life Extension
WB65 Data Mining in Medical and Biological Applications
WB66 Understanding and Prediction of Societal Crises
WB67 Condition Monitoring and Prognostics
WB68 Risk and Financial Decision-Making
WB69 Risk Management and Pricing in Operations
WB70 Health Information Systems
WB71 E Commerce
WB72 Adaptive Approximation Methods for Stochastic Optimization
WB73 Flow Shop Scheduling I

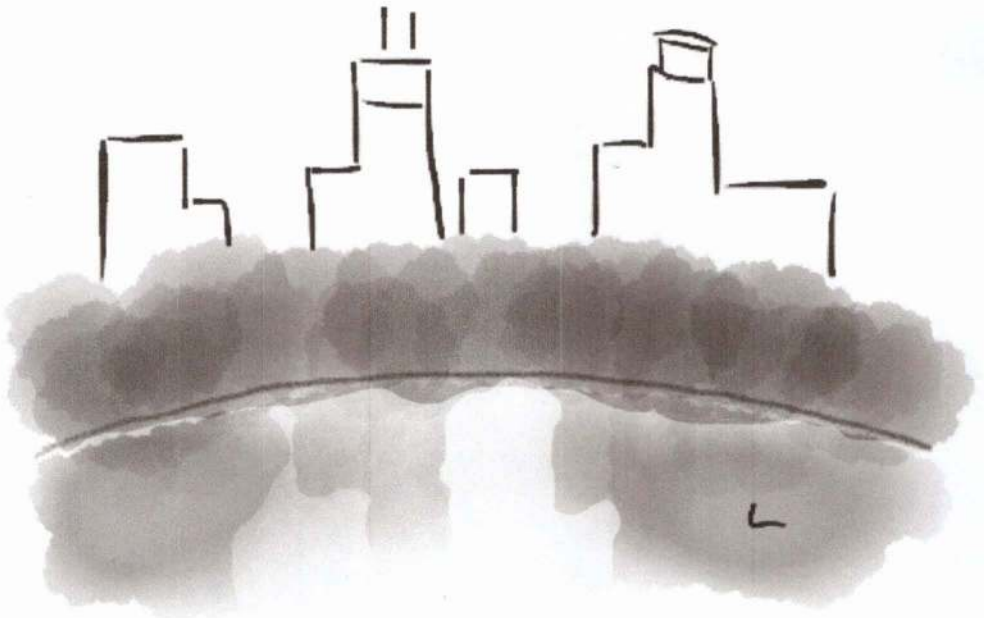
Wednesday, 1:30pm - 3:00pm

WC01 Optimization Methods with Applications in Energy Systems
WC03 Retail Operations Management
WC04 Advances in Dynamic Programming and Control
WC05 Statistical Methods for Process Optimization
WC06 Simulation and Computational Modeling of Individual Behaviors
WC07 Discovering Complex Anomalous Patterns
WC08 Joint Session SPPSN/MAS: Law Enforcement and Homeland Security I
WC09 Combinatorial Multi-Objective Optimization
WC10 Computation and Adaptation in Stochastic Regimes with Limited Information
WC11 Theoretical Non-linear Optimization

WC12 Binary Representations in Mixed Integer Programming
WC13 Integer Programming Applications
WC17 Strategies in Education
WC18 Optimization Methodologies: Polynomial and Other Problems
WC19 Operations Research for Public Health
WC20 Implementing OR/IE/MDM in Practice
WC21 Network Interdiction
WC22 Optimizing Power System Operation
WC23 Patient-Centered IT in Health Care
WC25 Health Engineering Applications
WC26 Managing Health and Risk of Suppliers
WC27 Service Operations: Contracting and Collaboration
WC28 Supply Chain Management and Information
WC29 Healthcare Operations and Patient Flow Management
WC30 Advances in Facility Location II
WC31 Economics of Queues
WC32 Issues in Humanitarian and Sustainable Supply Chains
WC33 Advertising and Promotion Effectiveness
WC34 Warehousing and Order-Picking
WC35 Revenue Management Practices in Media Industry
WC37 Dynamic Pricing and Applications
WC38 Big Data: Analytics and Applications
WC39 Topics in OM-Marketing Interface
WC40 Grids
WC41 Supply Chain in Petroleum / Petrochemical Companies
WC42 Network Design in Transportation
WC43 Strategic Issues in Rail Transportation
WC44 Supply Chain: Risk Management in Procurement
WC45 Joint Session MIF/HAS: Healthcare Informatics and Optimization
WC46 Corporate Considerations in Sustainabiity
WC48 Facility Logistics VI
WC49 School Bus Modeling
WC51 RAND Corporation Military Applications Research
WC52 Joint Session ENRE/OPTIM: Stochastic Programming Applications in the Energy Industry
WC53 Intelligent Algorithms on Smart Grids
WC55 Decisions in Product Development II
WC56 Emerging Topics in Technology Management
WC57 Decision Support Systems I
WC58 Stochastic Modeling in Health-care Applications
WC59 Sequencing Problems and Bandit Applications
WC60 Airline Operations Recovery
WC61 Decision Making in Homeland Security and Emergency Preparedness
WC62 Reliability I
WC64 Maintenance and Warranty
WC65 Applications of Data Mining II
WC66 Statistical Data Analysis for Manufacturing and Service System Design and Improvement
WC67 Mathematical and Experimental Methods for Characterizing Nanocrystal Growth
WC68 Modeling and Computation in Financial Engineering
WC69 Risk in Portfolio Management
WC70 Recommender Systems
WC71 Applications in Information Systems
WC72 Vehicle Routing Problems II
WC73 Scheduling for Single and Parallel Machines

Wednesday, 3:20pm - 4:50pm

WD01 Large Scale Combinatorial Optimization in Production and Logisitics
WD02 Joint Session DAS/MAS: Game Theory and Homeland Security II
WD03 Robust Ordinal Regression: State of the Art
WD04 Applications of Dynamic Programming and Control
WD05 Maintenance Optimization
WD07 Theoretical Methods in Data Mining
WD08 Applications of OR/MS in Voting and Election Processes
WD09 Trends in Multi-criteria Decision Analysis Applications
WD10 Stochastic Programming Models for Biofuel Supply Chains
WD11 Optimization: Nonlinear Programming
WD12 Applications and Algorithms for Integer Programming
WD13 Integer Programming in Production Settings
WD14 Metaheuristics for Vehicle Routing Problems
WD18 Optimization Methodologies: Multiple Objective Problems
WD19 Decision Analytic and Patient-Centered Modeling in Medicine
WD20 Healthcare Operations Management
WD21 Network Applications II
WD22 Stochastic Optimization for Resource Allocation
WD24 Optimization and Machine Learning Methods for Brain Data Analysis
WD25 Healthcare Applications of Operations Research
WD27 Strategic Supply and Strategic Consumers
WD28 Supply Chain and Operations Management
WD29 Challenges and Strategic Decisions in Healthcare Supply Chains
WD30 Applications of Facility Location
WD31 Customer Heterogeneity, Crowding, and Queueing Effects in Services
WD32 Supply Chain Procurement and Sourcing
WD33 Brand and Competition
WD34 Remanufacturing
WD35 Revenue Management in Online Advertising
WD37 Revenue Management: Yield Management
WD38 Service Technology: Smart Services
WD39 Combinatorial Optimization
WD40 Smart Grids
WD41 Panel Discussion: ENRE - Analytical Challenges in the Petroleum and Petrochemical industry
WD42 Storage of Energy
WD43 Routing and Timetabling in Rail
WD44 Supply Chain: Issues with Shipping and Transportation
WD45 Organization Theory
WD46 Traffic Flow Analysis for Network Modeling
WD47 Optimal Sensor Location
WD48 Facility Logistics VII
WD49 Urban Traffic Network Modeling
WD51 Military Innovation using Optimization
WD52 Renewable Energy Integration and Uncertainty Mitigation
WD53 Envisioning the Next Generation of Power Markets: Pricing
WD56 Natural Resources
WD57 Decision Support Systems II
WD60 Aircraft Maintenance Operations
WD61 Homeland Security
WD63 Flow Shop Scheduling II
WD64 Reliability II
WD65 Theory of Data Mining II
WD66 Multivariate Statistical Analysis for Quality and Reliability Improvement
WD67 Nanomanufacturing Processes and Systems: Modeling and Analysis
WD68 Financial Modeling
WD69 Risk Management and Financial Regulation
WD70 Economics of Online Markets
WD71 Software and Interconnectedness
WD72 Vehicle Routing with Environmental Considerations
WD73 Topics in Scheduling



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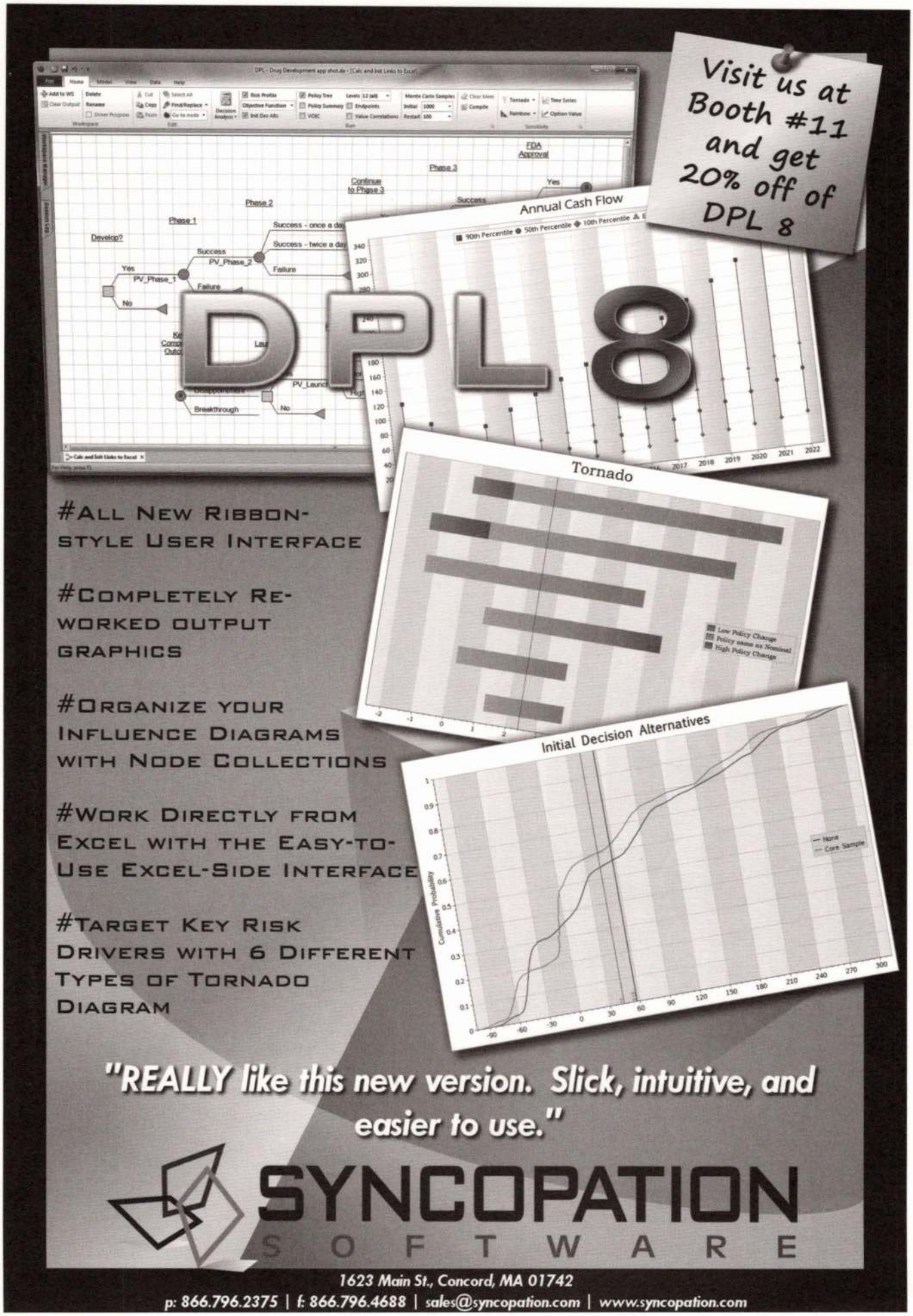
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